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Fishes Observed at Canadian Weatherships Ocean Station Papa (50°N, 145°W)

With Notes on the Trans-Pacific Cruise of the CSS Endeavour

Fishes Observed at Canadian Weathership Ocean Station Papa (50°N, 145°W) With Notes on the TransPacific Cruise of the CSS Endeavor

by

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ABBREVIATIONS

The following abbreviations and definitions are also used: BCPM = British Columbia Provincial Museum; CSS = Canadian Steam Ship; "diel" refers to migration of fishes from the surface at night to greater depth in daylight hours; "esca" refers to the bulbous and luminous tip of the illicium (= fishing rod) of angler fishes and "escal" is the adjectival reference to this structure; I-K = Isaacs-Kidd (Trawl); NMC = National Museums of Canada; S.L. = standard length; Stn. P. = Station Papa at 50°N and 145°W; Transpac = Transpacific in reference to cruise of CSS Endeavor; UBC = University of British Columbia; "$<$" = less than; "$>$" = more than.

The following abbreviations are used for photophores (= light organs): "AC" = photophores along side of body between origin of anal fin and base of tail; "AO" = photophores on lower side from anal fin origin to base of tail of Myctophids and "AOa" indicates the anterior portion of this row above anal fin; IV = photophores between gill isthmus and pelvic fins of Cyclothone; "OA" = photophores along side between pectoral area and above anal fin origin; "POL" = photophore(s) above AOa photophores and posterior portion of anal fin; "Prc" = photophores on lower posterior portion of tail; "SAO" = photophores on side of body between pelvics and anal fin (not "VO" series immediately below; "VAV" = photophores of Cyclothone between pelvic and anal fins; "VO" = photophores of Myctophids between pelvic and anal fins (see Wisner, 1974 and Mukhacheva, 1964 for details).

Fishes Observed at Canadian Weathership Ocean Station Papa (50°N, 145°W) With Notes on the TransPacific Cruise of the CSS Endeavor

ABSTRACT

Midwater fish species known to have been captured at the Canadian Oceanic Weathership Station Papa (50°N, 145°W) are listed along with notes on fishes captured during the 1969 transpacific cruise of the Canadian Steam Ship Endeavor. In addition, notes of Station Papa fishes in other regions are also included. Amongst the noteworthy records are: Avocettina infans (Nemichthyidae) as far north as the Aleutian Islands; Holtbyrnia macrops (Searsidae); Cyclothone pseudopallida, C. pallida, C. signata, Gonostoma gracilis (Gonostomatidae); Malacosteus danae (Malacosteidae); Benthalbella linguidens (Scopelarchidae); Lampanyctus jordani, reidentification of Notoscopelus off British Columbia as N. japonicus, identification of both Tarletonbeania crenularis and T. taylori from Station Papa (Myctophidae); addition of Chaenophryne melanorhabdus and doubt for C. parviconus off British Columbia (Oneirodidae); Gyrinominus sp. (Cetomimidae); and Halargyreus johnsoni (Moridae).

INTRODUCTION

From December, 1950, to June, 1981, the Government of Canada manned Weatherships at Stn. P. (50°00'N; 145°00'W - see Fig. 1), which made nearly continuous oceanographic observations as the ships were positioned within a grid 10 mile square. Although volumes of physical, oceanographic, meteorological, and biological productivity data were produced (i.e. Institute of Ocean Sciences, 1979 MS and previous issues), there are few accounts of the fish species found in this area.

McAllister (1959) reported on midwater fishes trawled near Stn. P. at 50°N, 135°W. LeBrasseur (1967) reported on fishes angled by weathership crew and Frost and McCrone (1979) reported on midwater fishes captured by midwater trawl in the upper 500 m of water. During C.G. Gruchy's voyages on the Weathership Quadra in 1969 to 1971, a non-closing, 2-m, Isaacs-Kidd (I-K) trawl was used. The ship's captain, A. K. Dykes used this net during additional tows. During August 1979, I was privileged to accompany Quadra and utilized a large, non-closing net (3 m by 6 m opening) designed by W. E. Barraclough (then of the Pacific Biological Station, Canadian Department of Fisheries and Oceans, Nanaimo, B.C.). Plankton mesh was used on the cod-end of most of these nets. Because of the danger of wasting valuable ship time by experimenting with the use of untried closing devices, we opted for the larger non-closing Barraclough net and towed it mostly below 500 m in order not to duplicate Frost and McCrone's work. However, nearly all tows reported in the present study are contaminated by fishes captured at shallower depths during descent and ascent of the net. Data for depth during tows of the Barraclough and Gruchy's I-K net were recorded on a clock-wound, time-depth recorder and the number of minutes of towing at each depth is recorded in Figure 2.

In the following account, most collections deposited at the National Museum of Canada (NMC) were assigned catalogue numbers between NMC 69-321 to 69-341, NMC 71-581 to 71-613, NMC 72-69 to 72-71, NMC 75-1532, NMC 76-0031, NMC 76-0089 to 76-0097, whereas those at the British Columbia Provincial Museum (BCPM) are assigned numbers BCPM 979-11220 to 979-11256. Because the gear used to sample NMC and BCPM specimens differentially selected the size of fish species (i.e. the larger BCPM net probably captured larger fish), data for these different nets are graphed separately. In each species account, only those specimens are listed which represent significant extensions of known geographic range, increase of known size, increased range of known depths, or otherwise represent unusual records. Because the NMC collections include a few fish from the 1969 transpacific cruise of the CCS Endeavor we include only the significant records. Methods of counts and measurements are those of Hubbs and Lagler (1964), except where described differently.

List of Fish Species

Lamnidae

Lamna ditropis Hubbs and Follett, 1947 — salmon shark

Angled by crew (LeBrasseur, 1967) and inhabiting most of N.E. Pacific including Stn. P. throughout the year.

Carcharhinidae

Prionace glauca (Linnaeus, 1758) — blue shark

Angled by crew (LeBrasseur, 1967 plus four specimens - BCPM 979-11231, 979-11246 and 979-11251) and migrates northward in summer when water temperatures exceed 12° C (Neave and Hanavan, 1967).

Nemichthyidae

Avocettina infans (Gunther, 1878) — closespine snipe eel

Our BCPM specimens (Fig. 3) were only taken in non-closing nets that fished at least 700 m depths during daylight. This suggests a deeper distribution than the 500 to 600 m recorded by Hart (1973) for British Columbia. Specimen (NMC 69-421) from Transpac. (49°14'N, 178°03'W - see Fig. 1) and the anterior segment of a specimen captured by the United States National Oceanic-Atmospheric Administration, National Marine Fisheries Service chartered vessel Ocean Harvester off Unalaska Island (BCPM 980-568; 53°03'N, 170°14'W: found by Peden on deck after fish was either regurgitated from predatory fish or slipped through mesh of net) greatly extends the known northward distribution recorded by Nielsen and Smith (1978). Our specimens, up to 557 mm S.L., (BCPM 979-11232) are larger than Hart's (1973) records for British Columbia but are much smaller than the 745 mm record of Nielsen and Smith (1978).

Salmonidae

Oncorhynchus species — Pacific salmon

Although five species of Oncorhynchus can be expected at Stn. P., LaBrasseur (1967) indicates O. kisutch represents 65% of the species caught during leisure hours by Weathership crew. Salmon are most commonly caught from January to June but move northward and are replaced by pomfrets during the warmer summer months (LeBrasseur, 1967; Neave and Hanavan, 1960).

Salmo gairdneri Richardson, 1836 — steelhead = rainbow trout

Steelhead are found at Stn. P. and move northward in summer similar to Oncorhynchus (LeBrasseur, 1967).

Argentinidae

Nansenia candida Cohen, 1958 — bluethroat argentine

Not taken at Stn. P. but was captured during Transpac. cruise at 49°34'N; 138°56.5'W (NMC 69-417; 140 mm S.L.).

Searsidae

Holtbyrnia macrops Maul, 1957 — teardrop tubeshoulder

Previous North Pacific records extend as far as 80 miles off Cape Flattery (Peden, 1975). Therefore, specimen BCPM 979-11245 (106 mm S.L. - see Fig. 4) from Stn. P. in

depths <650 m suggests a more northern occurrence. We have examined another specimen (107 mm S.L.) taken near Surveyor Seamount, Gulf of Alaska (approx. 57°N; 144°30'W) suggesting the species might be found throughout the Gulf of Alaska.

Bathylagidae

Bathylagus milleri Jordan and Gilbert, 1898 — stout blacksmelt

Our non-closing, daylight net samples at Stn. P. (Fig. 5) suggest young Bathylagus milleri (<60 mm S.L.) were most common between 500 and 600 m depths whereas larger fish (>100 mm) were in nets reaching 800 m or more.

Bathylagus ochotensis Schmidt, 1938 — popeye blacksmelt

This species was not taken at Stn. P. but three specimens (37, 41, and 59 mm S.L.) were taken on Transpac (NMC 69-424 from 41°10.5'N, 154°53'E; NMC 69-427 from 42°04'N, 153°50'E - see Fig. 1). Aron (1960) reports the species at 49°48'N and 145°46'W.

Bathylagus pacificus Gilbert, 1890 — slender blacksmelt

Young <70 mm S.L. were most abundant in daylight net hauls reaching 600 to 800 m depths (Fig. 6), whereas fish >100 mm were usually taken in hauls reaching 800 m or deeper.

Opisthoproctidae

Dolichopteryx sp. — winged spookfish

This undescribed species was recorded by Gruchy (in Hart, 1973) from Stn. P. Other uncatalogued material from the Gulf of Alaska and of similar large size (i.e. 154 mm S.L.) is housed in the College of Fisheries, University of Washington and indicates this form may be found throughout the northeast Pacific.

Macropinna microstoma Chapman, 1939 — barreleye

Our specimens at Stn. P. reach at least 120 mm S.L. (Figs. 7 and 8) and much larger than the 44 mm size noted by Hart (1973). They are from nets towed deeper than 500 m although the deeper hauls (1200 or 1300 m) may contain contaminants of shallower depths (Fig. 8).

Gonostomatidae

Cyclothone pacifica Mukhacheva, 1964 — yellow bristlemouth

We use the name Cyclothone pacifica Mukhacheva (1964) instead of C. microdon used by Hart (1973) for this abundant species in the North Pacific Ocean (see Fig. 10 and Peden, 1975). Although specimens from Stn. P. were found in nets towed as shallow as 500 m depths (Fig. 9), we found the species most numerous in daylight hauls that reached at least 1000 m.

Cyclothone pallida Brauer, 1902 — tan bristlemouth

A specimen of Cyclothone pallida (Fig. 10, BCPM 979-11255, 61 mm S.L.) was taken at Stn. P. at <800 m depths, another (BCPM 979-11252, 50.2 mm S.L.) at <600 m and a third (NMC 71-592, 65.7 mm S.L.) at <700 m. Although no scales are discernible, the specimens are otherwise in excellent condition. The number of gill rakers (8-9 + 12-13 = 21-23) preclude identification with C. pseudopallida (see Mukhacheva, 1964) or with Cyclothone sp. (of Berry and Perkins 1966; see Peden, 1975). Mukhacheva (1964) indicates C. pallida to be a more southern species and C. pseudopallida to more likely occur near Stn. P. However, the pectoral fins appear longer, reaching just short of the pelvics; the premaxillary teeth are not all equal in size and the second premaxillary tooth is larger and turned inward; the first two VAV photophores immediately behind the pelvics are not noticeably closer than other photophores in front of anus as is described for C. pallida (see Mukhacheva 1964).

The largest BCPM specimen has only one fang-like tooth on the anterior left side of the lower jaw but not the other fang-like teeth described for the premaxillae or at back of anterior series on lower jaw; nor the small teeth medial to second tooth of this series, but

they may have broken off. These teeth are visible on the NMC specimen. The precaudal glands are not as conspicuous as Mukhacheva describes, however, this may represent merely individual variation or faded specimens. Dorsal rays = 11-13, anal rays = 17-18, pectoral rays = 10-11, OA photophores = 8, IV photophores = 13, VAV photophores = 5, and AC photophores = 15 (only 13 remaining on NMC specimen).

Cyclothone pseudopallida Mukhacheva, 1964

We have a damaged specimen (NMC 71-587), 37 mm S.L., taken at Stn. P. in <450 m. Although the jaw bones are badly damaged, other characters distinguishing this form include: 12 + 6 = 18 gill rakers, 5 VAV photophores with the first two much closer together than remaining ones, anus considerably closer to pelvics than in C. pallida. Other counts are: dorsal = 11; anal = 16 + ?; branchiostegal photophores = 9; IV photophores = 12; AC photophores = 14.

Mukhacheva's (1964) distribution maps suggests C. pseudopallida is more likely to be found further north than C. pallida, however, our collections clearly indicate that both species may occur at Stn. P. Peden (1975) identified a specimen from off Cape Flattery as Cyclothone sp. (of Berry and Perkins, 1966) but now that we have compared our material with additional specimens we believe that record should also be synonymized with C. pseudopallida.

Cyclothone signata Garman, 1899 showy bristlemouth

Peden (1975) recorded Cyclothone signata as far north as Cape Flattery; therefore, our specimen (BCPM 979-11250, approximately 35 mm S.L. - Fig. 10) from Stn. P. at depths <800 m represents a significant northward extension of known geographic range.

Gonostoma gracilis Gunther, 1878 slender fangjaw

Gonostoma gracilis is known from the western Pacific at about 39° to 40° N. Lat. off Japan (Mead and Taylor, 1953). Our Transpac. collections further substantiates its greater abundance during the western segment of the Transpac cruise (NMC 69-421 with three specimens at 80 to 86 mm S.L.; NMC 69-424 with 9 at 35 to 62 mm; NMC 69-425 with 4 at 25 to 44 mm; NMC 69-426 with 7 at 36 to 68 mm; NMC 69-427 with 29 at 50 to 76 mm; NMC 69-428 with 4 at 63 to 74 mm; and NMC 69-429 with 4 at 20 to 79 mm S.L. - see Fig. 1) since these collections were taken west of 177°W. Long.

We have a larger specimen (108 mm S.L., see Fig. 11) taken at <800 m at Stn. P. (BCPM 979-11250) demonstrating a more northern and eastern occurrence; however, Howe, Stein, and Bond (1980) record another species, G. atlanticum from nearby waters off Oregon.

Maurolicus japonicus Ishikawa, 1915

We have only one specimen (26 mm S.L.) from Transpac. (41°40'N, 148°30.5'E, NMC 69-426). Not taken at Stn. P.

Sternoptychidae

Argyropelecus lychnus Garman, 1899 silvery hatchetfish

Not taken at Stn. P. We have two specimens (12 and 18 mm S.L.) from Transpac. (37°08'N, 146°11'E).

Melanostomiidae

Bathophilus flemingi Aron and McCrery, 1958 highfin dragonfish

Three specimens (125 to 136 mm S.L.) from BCPM 979-11241 and two (111 and 117 mm S.L.) from BCPM 979-11247 were taken at Stn. P. during night tows at <60 m.

Tactostoma macropus Bolin, 1939 longfin dragonfish

Most of our specimens (Fig. 12) were taken in nets towed during daylight hours when the net descended to, or below 600 m. Some individuals in the larger BCPM net equal the 34 cm sizes noted by Hart (1973). The species was also taken across the entire North Pacific on

Transpac. (NMC 69-416 with 10 fish between 69 and 158 mm S.L.; NMC 69-417 with 2 at 132 and 274 mm; NMC 69-420 with 2 at 139 and 146 mm; NMC 69-421 with 1 at 123 mm; NMC 69-424 with 3 at 76 to 131 mm and NMC 69-438 with one at 163 mm).

Malacosteidae

Aristostomias scintillans (Gilbert, 1915) — shining loosejaw

Daylight tows at Stn. P. captured Aristostomias scintillans in tows that descended to 600 or 800 m depths (Fig. 13), however, night tows at <60 m captured smaller specimens at much shallower depths.

Malacosteus danae Regan and Trewavas 1930 — shortnose loosejaw

A specimen 142 mm S.L. (Fig. 14) was taken at Stn. P. in depths <650 m (BCPM 979-11245) and readily identified as Malacosteus danae (see Morrow 1964). The closest previous records appear to be from California (Hubbs, Follett and Dempster 1979) thus indicating that our specimen represents a significant extension of known geographic range.

Chauliodontidae

Chauliodus macouni Bean, 1890 — Pacific viperfish

Chauliodus macouni was taken in a wide range of water depths (Fig. 15) with individuals under 100 mm S.L. being common at 500 m or deeper. Larger fish over 100 mm S.L. were not encountered until nets reached at least 600 m. Our specimens of at least 240 mm S.L. are larger than those reported by Hart (1973) although we have heard of considerably larger specimens recently taken off California.

Alepisauridae

Alepisaurus ferox Lowe, 1833 — longnose lancetfish

This fish was frequently angled by the crews of the weatherships at Stn. P. where it was considered to be a nuisance because it wraps itself around the fish line. Seventy-two specimens were recorded from here (LeBrasseur 1967). Two others, caught in 1976, are catalogued BCPM 976-1376.

Anotopteridae

Anotopterus pharao Zugmayer, 1911 — daggertooth

This species was inadvertently angled by weathership crews, while they fished for salmon. At times, it may have been confused with Benthodesmus (see LeBrasseur 1967) or Alepisaurus. Smaller specimens of 452 mm S.L. (BCPM 980-406), 523 mm S.L. (BCPM 980-511), and 263 mm S.L. (BCPM 980-512) are catalogued with one specimen having two large, pelagic, juvenile Hexagrammos in its stomach.

Scopelarchidae

Benthalbella dentata (Chapman, 1939) — northern pearleye

The northern pearleye was taken in nets towed at 500 m or deeper (Figs. 16 and 17).

Benthalbella linguidens (Mead and Bohlke 1953) — longfin pearleye

Two large specimens of Benthalbella linguidens were taken at Stn. P. in depths <650 m (BCPM 979-11245, Fig. 17) and their counts are listed in Table 1. Johnson (1974) noted that the species is known from only 13 larva plus one adult of 221 mm S.L. and captured in 1000 m depths. We originally thought the BCPM specimens increased the known size range, however, Iwami and Abe (1980) report a 302 mm specimen from the Bonnin Islands.

Another uncatalogued specimen at the University of Washington was examined by Peden. Its capture from Surveyer Seamount (about 57°N, 138°56.5'W) suggests a wider distribution into the Gulf of Alaska.

Paralepididae

Lestidiops ringens (Jordan & Gilbert, 1881) slender barracudina

Two specimens (109 and 114 mm S.L.) were taken at Stn. P. at ≤60 m (BCPM 979-11241) and another nine specimens (106 to 114 mm S.L.) at ≤50 m (BCPM 979-11247).

Hart's (1973) description is somewhat misleading. Our specimens have one to three teeth (more in larger fish) on each ossified tooth bearing plate of the first gill arch; one of Hart's key characters describes four (possibly a switched couplet in his key). Furthermore, Miller and Lea (1972), as well as Hart, describe 28 to 33 anal rays, whereas we find between 26 to 29 (last two elements counted as one) on our specimens (Table 2).

Rofen (1966:302) recognizes L. elongatum (Ege) as just a northern population of L. ringens. We find all our specimens off British Columbia and at Stn. P. similar to Ege's (1953) elongatum. However, examination of southern collections are needed to determine the nature of the reverse north/south cline between northern and southern collections. Our largest specimen (218 mm S.L.) from off Bamfield is larger than the 209 mm record of Hart (1973).

Paralepis atlantica Kroyer, 1868 duckbill barracudina

Reported by Peden (1980) at Stn. P. A second specimen from waters off western Canada is being recorded by Carveth and Peden.

Myctophidae

Diaphus theta Eigenmann and Eigenmann, 1890 California headlightfish

Most Diaphus theta caught at Stn. P. are from night tows at ≤60 m (Fig 18). The majority of specimens from tows below 500 m were caught during daylight hours, however, many specimens are undoubtedly contaminants from shallower depths. Frost and McCrone (1979) demonstrated vertical diel migration from the surface at night to approximately 400 m in daylight hours and the length frequencies in his samples are similar to ours (Fig. 18).

We examined our collections from Stn. P. to determine if Diaphus rafinesquii, known from further south (Wisner, 1974), was present. A few specimens did have an elevated AO_a photophore, but other characters clearly indicate that our samples were D. theta. Counts on 20 specimens are: dorsal 13.12 (12-14), anal 12.87 (12-14), pectoral 11.2 (11-12), AO photophores 5.15 (4-6) + 5.3 (5-7) = 11.15 (10-12), gill rakers 14.3 (13-16) + 1 + 7.35 (7-8), total rakers = 22.6 (21-22), precaudal vertebrae 15.65 (14-16), caudal vertebrae 20.17 (19-24), total vertebrae = 35.75 (35-36). The presence of an additional gill raker compared to those off southern California is consistent with the difference described by Wisner for northern populations. The pectoral count is also higher (by one ray) compared to his descriptions.

Lampanyctus jordani Gilbert 1913 brokenline lanternfish

A few large specimens were taken at Stn. P. at or below 600 m (Figs. 19 and 20) and correspond to Wisner's (1974) description of L. jordani, a species occurring in the western North Pacific with only one record from the Eastern Pacific (off California). Our Stn. P. fish are the closest specimens known near Canadian territorial fishing waters. Other specimens were taken on Transpac. Our specimens had more dorsal rays, fewer pectoral rays, and more gill rakers than those recorded by Wisner, however our method of including principle dorsal rays or including rudimentary rakers probably differs (Table 3).

Lampanyctus regalis (Gilbert, 1892) pinpoint lanternfish

Lampanyctus regalis was taken at Stn. P. in nets reaching below 600 m (Fig. 19).

A possible new form related to L. regalis is described from nearshore waters off Oregon (Wisner, 1974). It is characterized by more dorsal (17), anal (19), and pectoral (14) rays, as well as different numbers of AO photophores and gill rakers (Wisner, 1974). Our material would appear to be more similar to the typical form of L. regalis although the combination of AO photophores are not in agreement, and we include more nubs in the gill-raker counts (Table 4).

Lampanyctus ritteri Gilbert, 1915 broadfin lanternfish

Our specimens of L. ritteri from Stn. P. were taken only at night at 60 m but the species was missed in our deeper daylight hauls (Fig. 19). Other specimens were taken further east at Stn. NMC 69-438 (Fig. 1).

Mean counts for gill raker and vertebrae (Table 5) average higher than those counted by Wisner (1974). Again, more rudimentary gill rakers are included in our counts. According to the distribution recorded by Wisner, Stn. P. is near the northwestern limits of the species range.

Notoscopelus japonicus (Tanaka, 1908) flourescent lampfish

We have a specimen of Notoscopelus japonicus from near the Asiatic coast (NMC 69-424, Fig. 1) and another from Stn. P. (NMC 69-334). The nomenclatural history of Notoscopelus off British Columbia has been inconsistent. The original record quoted by Clemens and Wilby (1961) was based on a record of Aron's (1960) identified as N. elongatus. However, this record was reidentified as N. resplendens Richardson by Clemens and Wilby (1961), Hart (1973), and Jean, Peden and McAllister (1982). Furthermore, Clemens and Wilby's figure number 72 (p.151) for this species is actually inverted with Fig. 70 (p. 148) for Lampanyctus ritteri and this has undoubtedly led to misidentifications by many readers. Aron's specimen on which the British Columbia record was based actually came from outside Canadian territorial fishing waters ($49^{\circ}24'$N, $140^{\circ}38'$W). Hart (1973) mentions an additional record within Canadian waters (52.17°N, 133.10°W). Unfortunately, his figure (based on specimen #UBC 65-621) does not even fit the generic description (i.e. 2 POL photophores horizontally alligned near lateral line) and would seem to key out to Lampanyctus ritteri although we have not examined or been able to locate that specimen.

Wisner (1974) described southern specimens of Notoscopelus off California as N. resplendens and compared them to two specimens identified by Bolin (1939) as N. elongatus. The recent myctophid papers of Nafpaktitis (1975) and Nafpaktitis et al. (1977), suggests N. elongatus (to which our specimens could be identified in their key to Atlantic species) is restricted to Atlantic waters. They describe Notoscopelus japonicus as being restricted to the western north Pacific Ocean whereas N. resplendens is distributed in the Atlantic, Pacific and Indian Oceans.

Nafpaktitis also refers to Bolin's (1959) comments that N. japonicus is readily identifiable from other Notoscopelus species because of the presence of ctenoid scales. Furthermore, the species has 2 + 2 Prc rather than only 2 + 1 Prc photophores characteristic of all Atlantic species. In addition specimen NMC 69-334 still retains ctenoid lateral line scales and NMC 69-424 has ctenoid scales over the abdomen. Since we cannot yet confirm the identity of specimen UBC 65-621 or other reputed Notoscopelus from western Canadian waters, we must question the identification of a western Canadian population. On the other hand we suspect N. japonicus will probably be found in Canadian waters. The species is illustrated in a photograph published by Mead and Taylor (1953) and Table 6 lists counts and measurements for our specimens.

Even though we included all rudimentary rakers in our gill raker counts, there are not enough nubs to compensate for the differences between Wisner's (1974) data for N. resplendens and ours for N. japonicus.

Protomyctophum thompsoni (Chapman 1944) flashlightfish

Protomyctophum thompsoni was usually taken at Stn. P. in daylight hauls of 300 m or deeper (Fig. 21). Frost and McCrone (1979) indicate a preferred depth range (day and night) between 200 to 500 m. Most captures in our deeper hauls are probably contaminants from shallower depths.

Because Wisner (1974) records P. crockeri on his distribution map to near 48°N Lat., we

examined all specimens very closely but only found P. thompsoni in Stn. P. collections. However, not all specimens were identifiable in Wisner's key. In particular, the interorbit is very narrow in juveniles and apparently becomes wider as the fish grows (Fig. 22). Although Wisner suggests some species have more telescopic eyes with an upward displacement of lens and pupil, our P. thompsoni apparently has a shift from the telescopic conditions in young to a more normal eye in adults (Fig. 23). Because Wisner used this character with an allometric growth pattern to identify the nominal subgenus Hierops, closer study of allied species are needed to determine the validity of this subgenus. Our specimens still have the upper orbital margins parallel and not converging anteriorly as Wisner describes for other subgenera. Counts are presented in Table 7.

Stenobrachius leucopsarus (Eigenmann and Eigenmann 1890) northern lanternfish

Frost and McCrone (1979) demonstrated that Stenobrachius leucopsarus of 19 to 35 mm S.L. migrated from about 300 m depths during daylight to $<$50 m at night. Larger specimens (90 to 112 mm S.L.) migrated to 400 m or more during daylight. Our less-refined gear support these findings (Fig. 24) even though our deepest captures are probably contaminants as the net passed through shallower depths.

Because the position of photophores (particularly in the "VO" and "SAO" series) varied, we tabulated these features to determine if there was variation between inshore and offshore populations (Table 8).

Because we included rudimentary rakers, our gill raker counts were higher than those of Wisner (1974). Our Stn. P. specimens (BCPM 979-11241) also had one more pectoral ray than Wisner's.

Counts of 20 Stn. P. specimens are: dorsal 13.75 (13-15), anal 14.9 (14-16), pectoral 10.3 (10-11), AO photophores 6(4-7)+7(7-8)=13.05 (12-14), gill rakers 13.75(13-14)+1+6.45(6-7)=20.8(20-22), total vertebrae 36.3(36-37). See S. nannochir for variation in other characters.

Stenobrachius nannochir (Gilbert 1890) garnet lanternfish

Peden (1975) recounted some of the confused history of Stenobrachius nannochir and S. leucopsarus populations off British Columbia. Stenobrachius nannochir is a deeper water form with few found above 500 m depths (Frost and McCrone 1979). Our hauls from below 500 m captured proportionally many more S. nannochir than S. leucopsarus (see Figs. 24 and 25) and specimens $<$ 50 mm S.L. were most abundant near 600 m depths and the largest fish (up to 124 mm S.L.) common in 800 m depths. None were taken shallower than 500 m.

Even though specimens tend to be badly abraded in net tows we readily differentiated most from S. leucopsarus. See Tables 9 to 12 and Figs. 26 to 32.

Additional counts for 20 specimens of S. nannochir from Stn. P. are: dorsal 13.4(13-14), anal 14.6(14-16), pectoral 9.6(8-10), total vertebrae 37.3(36-39), AO photophores 6.8(6-8)+6.8(5-8)=13.2(13-14), lateral line scale pockets 37.6(37-38 on 17 specimens), gill rakers 13.9(13-16)+1+7.2(7-8)= 22.2(21-25).

Symbolophorus californiensis californiensis (Eigenmann and Eigenmann, 1889) bigfin lanternfish

Our few specimens are from 41°10.5'N, 154°55'E; 42°04'N, 153°50'E; 49°N, 150°W, and two from Stn. P. Counts of specimens near Stn. P. are dorsal 14-15, anal 21, pectoral 15, AO photophores 7 + 10 = 17, gill rakers 16-17+1+6-7= 23-25, total vertebrae 40. Lateral line scales and/or pockets 42-46, head length .247-.257 of S.L., upper jaw .677-.681 of head length. Wisner (1974) notes specimens off Japan have higher counts and may be a different species.

Tarletonbeania crenularis (Jordan and Gilbert, 1880) blue lanternfish

Most of our Tarletonbeania from Stn. P. are T. taylori (see Wisner, 1959, 1974); however, one specimen from NMC 69-326 is definitely T. crenularis, and two others (NMC 71-594) appear to be hybrids (see account for T. taylori).

Tarletonbeania taylori Mead, 1953 tail-light lanternfish

Because most specimens of T. taylori were taken near the surface during the hours of darkness at Stn. P. (Fig. 33), those from much deeper tows are probably contaminants from shallower depths. This was the only lanternfish species attracted to our surface lights at night. Furthermore, LeBrasseur (1964) indicates Tarletonbeania to be the most common lanternfish distributed near the surface at night in the upper 20 m above the thermocline in the offshore waters of British Columbia. He found that Diaphus were concentrated at 20 to 30 m in the thermocline and Stenobrachius below the thermocline between 40 to 60 m.

Wisner (1959, 1974) resurrects the forms taylori and crenularis to full species status solely on the basis of the short but bulky supracaudal and infracaudal luminous glands of male taylori. Male crenularis have a long, but thin supracaudal gland and the infracaudal gland may be absent or occasionally respresented as a long, thin strip. BCPM material from British Columbia and Stn. P. contained one specimen of crenularis (Fig. 34) plus two intermediates (possibly hybrids) possessing short bulky supracaudal glands with a thin segment extending further anteriorly. We had interpreted this to suggest subspecies that merge off British Columbia as did Becker (1964) who recognized T. c. crenularis from the eastern Pacific and T. c. taylori from the western Pacific. Recently we examined a large collection at UBC with numerous males of each species suggesting sympatry and no hybrids suggesting full species status. On the other hand, does this collection include expatriates from spawnings outside the area of sympatry or does it represent the result of spawning in sympatry with operating isolating mechanisms ?

LeBrasseur (pers. comm.) kindly lent us unpublished data for relative length of the supracaudal gland based on 40 "crenularis", 62 "taylori" and 23 "hybrids" ranging between 25 and 70 mm S.L. T. taylori possessed glands, mostly less than 12% of standard length, whereas hybrids plus most T. crenularis males had larger glands of more than 12%. A long, thin anterior extension from the otherwise thick taylori-like gland characterizes the hybrids.

In spite of the fact that females cannot be differentiated into taylori or crenularis, we now believe it is preferable to recognize both forms as species and thus emphasize the existence of two recognizable populations, and also draw attention to an unsolved species problem.

Oneirodidae

Oneirodes bulbosus Chapman 1939 bulbous dreamer

We obtained a single specimen 41 mm S.L. (BCPM 979-11239 - Fig. 35) from <800 m at Stn. P., a 32 mm S.L. specimen (BCPM 979-11252) from <600 m and a third specimen 45 mm S.L. (NMC 69-326) from <800 m. Their escal morphology and other external characters are identical to the diagnostic features reported by Pietsch (1974). Hart (1973) followed Bertelson (1951) and synonymized British Columbia records of this species with the O. eschrichti - group of Lutken. Jean, Peden and McAllister (1982) also followed this practice. Since our new Stn. P. specimens are so readily identifiable with the Pietsch (1974) description of O. bulbosus we believe O. bulbosus should be the recognized form off British Columbia.

Oneirodes thompsoni (Schultz 1934) spiny dreamer

A 37 mm S.L. specimen of Oneirodes thompsoni (BCPM 979-11239 - Fig. 36) was taken from < 750 m depths at Stn. P. and another (NMC 78-0086) of 35 mm S.L. was taken in a 1200 m vertical haul. Escal and other external morphology are readily identifiable with the description of Pietsch (1974) who distinguishes populations off British Columbia from O. acanthias (Gilbert), the name recognized by Hart (1973) for specimens in this region.

Chaenophryne melanorhabdus Regan and Trewaves 1932 blobby dreamer

Re-examination of the specimen identified as Oneirodes sp. off Cape Flattery (Peden, 1975) indicates yet another species of dreamer off British Columbia. Theodore Pietsch kindly identified the specimen as referable to the form described in his 1975 publication.

Although not from Stn. P., we illustrate the form (Fig. 37) since the only published British Columbia record of Chaenophryne is based on a damaged specimen unidentifiable as to species (Taylor, 1967). Taylor's specimen was identified as C. parviconus on geographical grounds within the framework of available literature at that time, although Pietsch (1975)

later described this and another form (C. longiceps) that may reach nearby waters off Oregon and Washington. Hart (1973) inadvertently used an illustration from Bertelson since a complete local specimen was not available for the purpose but he obviously did not illustrate the local form. We think Hart used the esca illustrated by Bertelson (1951) and attached it to the body of C. longiceps illustrated by Regan (1926). C. melanorhabdus has one more anal and dorsal ray and no sphenotic spines in contrast to Oneirodes. Its esca is distinctive (see Pietsch, 1974, 1975).

Cetomimidae

Gyrinomimus sp. — flabby whalefish

We obtained a specimen, 139 mm S.L. from Stn. P. (BCPM 979-11242).

John R. Paxton of the Australian Museum is doing the major revision of these fishes and tells us that the specimen is likely to be one of six undescribed species of Gyrinomimus which he will describe shortly (see Fig. 38).

Macrouridae

Coryphaenoides acrolepis (Bean, 1883) — roughscale grenadier

We have specimens of 68 mm T.L. (tail broken) and 89 mm T.L. (BCPM 979-11235, Stn. P. at <1000 m depths), 95 mm T.L. (NMC 71-591, Stn. P. at <825 m), 602 mm S.L. (BCPM 980-408, Stn. P. from between 1000 and 2000 m - captured in vertical tow by R. Conway, Department of Oceanography, Oregon State University, aboard Weathership Vancouver), and 616 mm S.L. (BCPM 980-409, Stn. P., reputedly from 189 m, from Weathership Vancouver). They have been identified as Coryphaenoides acrolepis through the courtesy of David Stein (personal communication), Department of Oceanography, Oregon State University.

Because postlarval and even juvenile macrourids can be expected to represent a midwater-pelagic stage, their occurrence at Stn. P. is not surprising. Those 600 mm S.L. are significant since they were captured in relatively shallow depths in waters 4000 m deep. Although such offshore occurrences are discussed by Iwamoto and Stein (1974) they do not list records as shallow as 200 m and we doubt the accuracy for datum on depth in collection BCPM 980-409. Stein (1980) describes morphology and identification of juvenile macrourids.

??Coryphaenoides cinereus (Gilbert, 1893) — popeye

We have a specimen 182 mm S.L. (BCPM 979-1242 from Stn. P. at <1250 m) which is identified tentatively as Coryphaenoides cinereus by David Stein (personal communication) who suggests that other species of macrourids in addition to C. acolepis may enter the midwaters of the North Pacific at least during their juvenile stages.

??Coryphaenoides filifer (Gilbert, 1895) — filamented rattail

Two specimens of 24 and 27 mm S.L. (approx.) were taken at Stn. P. (NMC 71-612, at <450 m) and their small size suggest a small midwater juvenile stage. Although not identified as Coryphaenoides filifer with certainty by David Stein (personal communication) we list these specimens to note the species possible occurrence at Stn. P. Stein (1980) discusses the morphology and identification of the juveniles of this species.

Coryphaenoides pectoralis (Gilbert, 1891) — pectoral rattail

We have a specimen 232 mm S.L. (from Stn. P. at <1500 m depths) identified as Coryphaenoides pectoralis by Tomio Iwamoto (see Iwamoto and Stein, 1974) suggesting that larger juveniles of this species might enter the midwaters of Stn. P. The specimen label indicates it was captured at <800 m although the NMC catalogue data suggests the depths record is <1500 m).

Moridae

Halargyreus johnsoni Gunther 1862 — dainty mora

A specimen, 195 mm S.L. (Fig. 39), was captured at Stn. P. on 25 August 1971. Capture depth was probably 1500 meters (3000 meters of wire out) and a non-closing I-K midwater trawl was used.

The species is known from the Atlantic Ocean and off New Zealand (Templeman 1968). Cohen (1973) reported the first southern Pacific specimens but preferred to treat Fitch and Brownell's (1968) record off Japan as tentative because it was based on "badly digested" otoliths from the stomach of a pygmy sperm whale. Subsequently Kanayama et al. (1978) reported specimens off southern Japan. Our record from Stn. P. is apparently the first known whole specimen from the northeastern Pacific Ocean.

Cohen (1975) justifies the use of the family name Moridae over Eretmorphoridae. Our specimen agrees with Templeman's (1968) and Norman's (1966) diagnosis of this monotypic genus with respect to: lower jaw extending slightly beyond the upper, a tubercle (symphyseal knob) on lower jaw symphysis, no vomerine or palatine teeth, no barbel, scales extending to tip of snout, operculum and subopperculum each with a very small spine lying close to each other, anterior gill rakers of first arch longer than gill space filaments, a free caudal peduncle, two dorsal fins and anal fin deeply notched with notch in middle portion of fin.

Our specimen is assigned catalogue number NMC 76-0031 and has 6 + 54 soft dorsal rays, 46 anal rays, 17 pectoral rays, 5 (2 elongate) pelvic rays and 5 + 1 + 21 gill rakers. The head length (30% of standard length) is larger than the range (23.8 - 26.8) reported by Templeman (1968).

Scomberesocidae

Cololabis saira (Brevoort 1856) — Pacific saury

Many seen at Stn. P. when attracted to a surface light at night. Records from 1300 and 1900 m (Fig. 40) are undoubtedly contaminants from shallower depths.

Melamphaidae

Melamphaes lugubris Gilbert, 1890 — highsnout ridgehead

At Stn. P., Melamphaes lugubris was found in hauls reaching $>$800 m (Fig. 41). We also have a 50 mm S.L. specimen from 350 m at 48°36'N, and 177°29'E.

Poromitra crassiceps (Gunther, 1878) — crested ridgehead

Mostly taken at Stn. P. in nets reaching deeper than 600 m (Fig. 42).

Oreosomatidae

Allocyttus sp. — oreo

Taken in stomach of Alepisaurus ferox at Stn. P. (Hart, 1973). The form was not previously known from British Columbia's territorial fishing waters, although juveniles are known from Stn. P. and similar extra-territorial areas. Nagtegaal will soon publish a record of an adult specimen from provincial waters.

Carangidae

Trachurus symmetricus (Ayres, 1855) — jack mackerel

Angled by crew at Stn. P. during their leisure hours from Jul. to October (LaBrasseur, 1967).

Bramidae

Brama japonica Hilgendorf, 1878 — **Pacific pomfret**

Extremely abundant from July to November at Stn. P. (LeBrasseur, 1967) and almost the only fish species caught on hook and line by A.E. Peden during the cruise of the Weathership Quadra in August 1979.

Pentacerotidae

Pentaceros richardsoni Smith 1849 — pelagic armorhead

Taken at Stn. P. by Weathership Fort Ross in 1958 (Neave, 1959).

Anoplopomatidae

Erilepis zonifer (Lockington, 1880) — skilfish

Smaller individuals occasionally angled at Stn. P. and a few of these reared at Vancouver Public Aquarium (Hart, 1973).

Other Larvae and Juveniles Found at Station Papa

As most larvae and juveniles of shore-living species might be considered expatriates from another ecosystem, we merely list their captures without explanation.

Family	Species	Range of S.L.
Scorpaenidae	Sebastes sp. (LeBrasseur 1967?)	?
Cottidae	Hemilepidotus hemilepidotus	16-19 mm
Hexagrammidae	Hexagrammos octogrammus	38-42 mm
Hexagrammidae	Hexagrammos lagocephalus	54-59 mm
Hexagrammidae	Hexagrammos decagrammus	?

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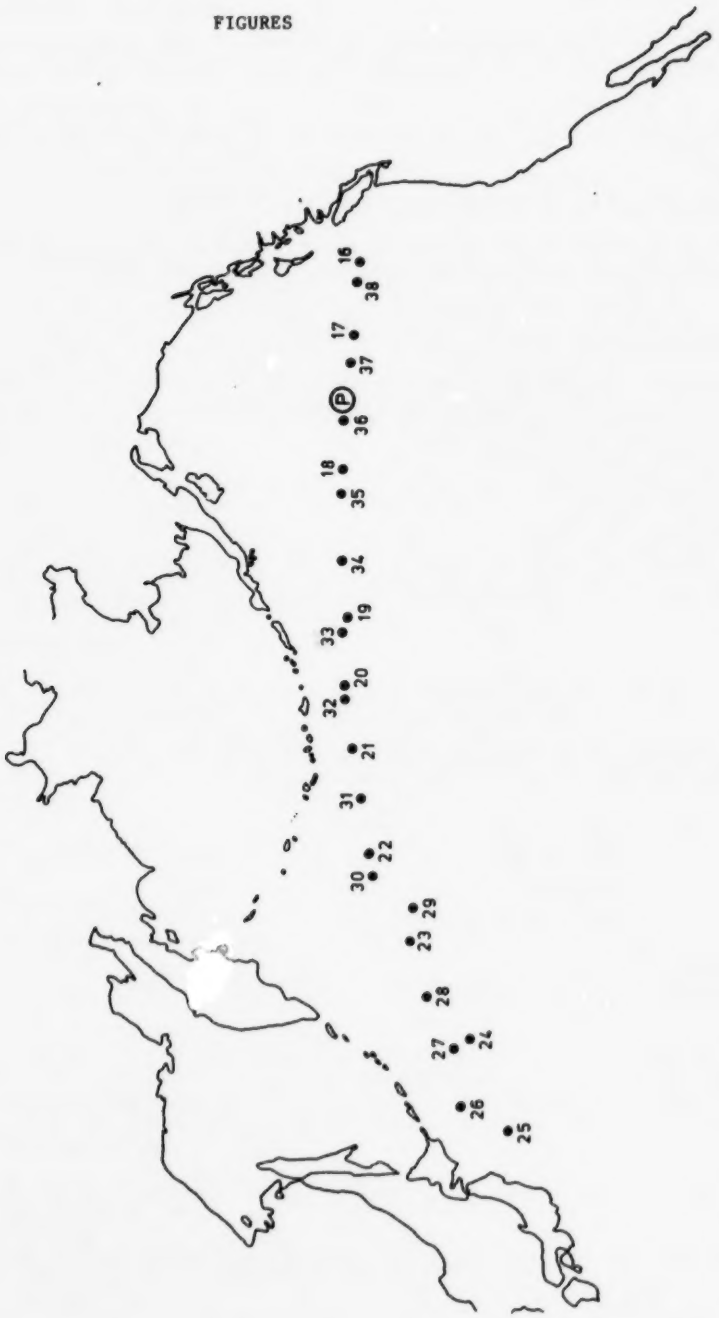

Figure 1. The North Pacific Ocean showing position of Ocean Station Papa (indicated by "P") and the stations from the transpacific cruise of the CSS Endeavor. Station numbers refer to National Museum of Canada catalogue numbers with prefix NMC "69-4" and should read from NMC 69-416 to NMC 69-438.

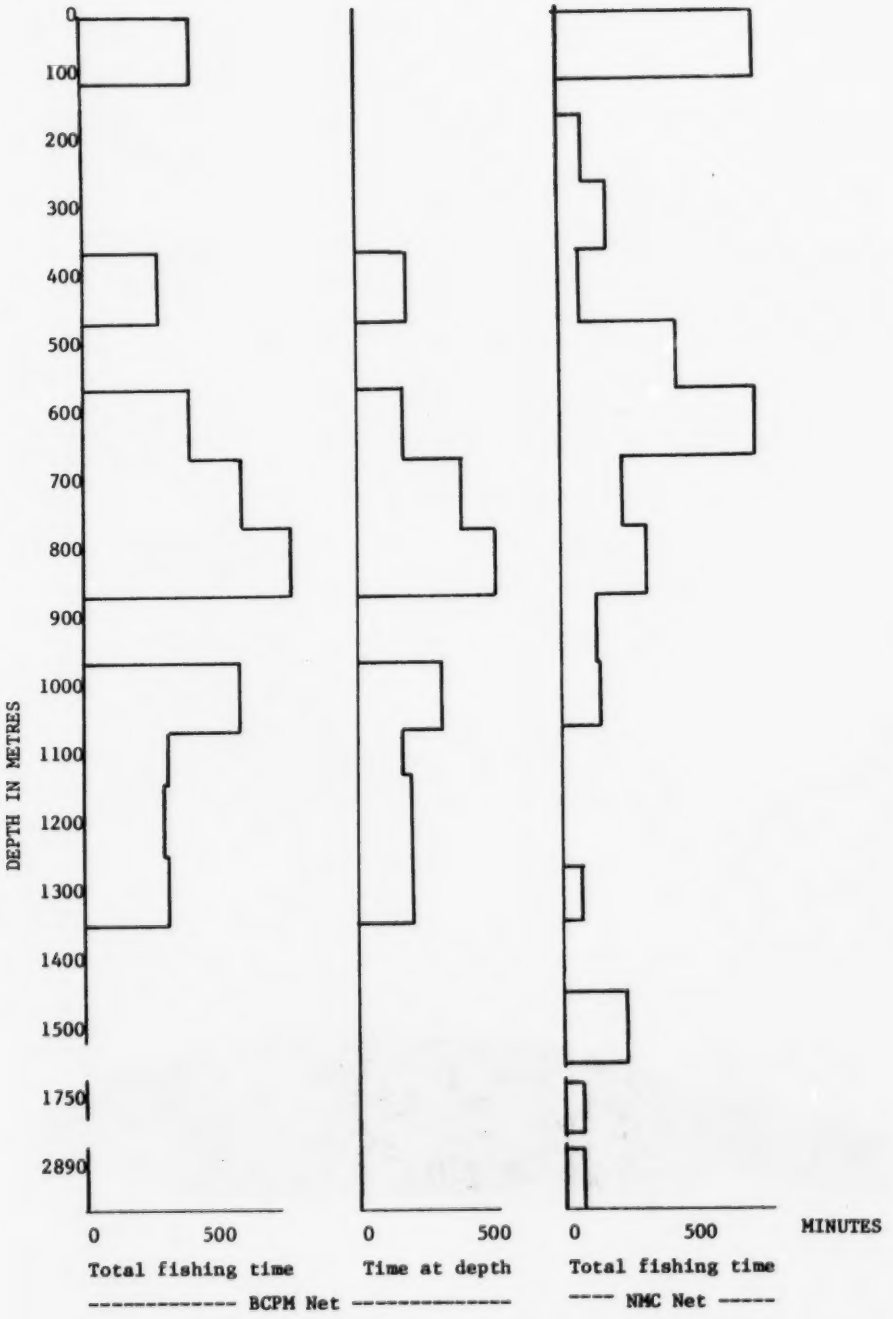

Figure 2. Fishing time of nets towed at different depths. "NMC net" refers to 2 m x 2 m Isaacs-Kidd trawl used by C.G. Gruchy or Captain A.R. Dykes for the National Museum of Canada. "BCPM net" refers to 3 m x 6 m net used by staff of the British Columbia Provincial Museum and designed by W.E. Barraclough. Hauls at 100 m depth or less were towed during the night and deeper BCPM tows were daytime hauls.

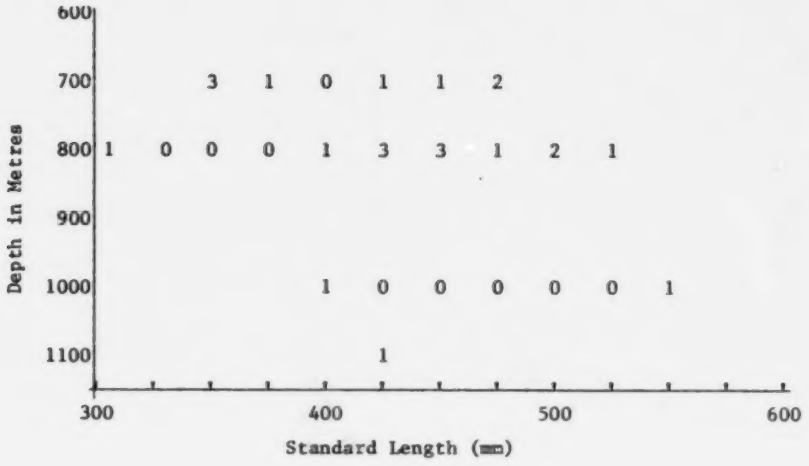

Figure 3. Depths at which Avocettina infans of different sizes were caught at Stn. P.

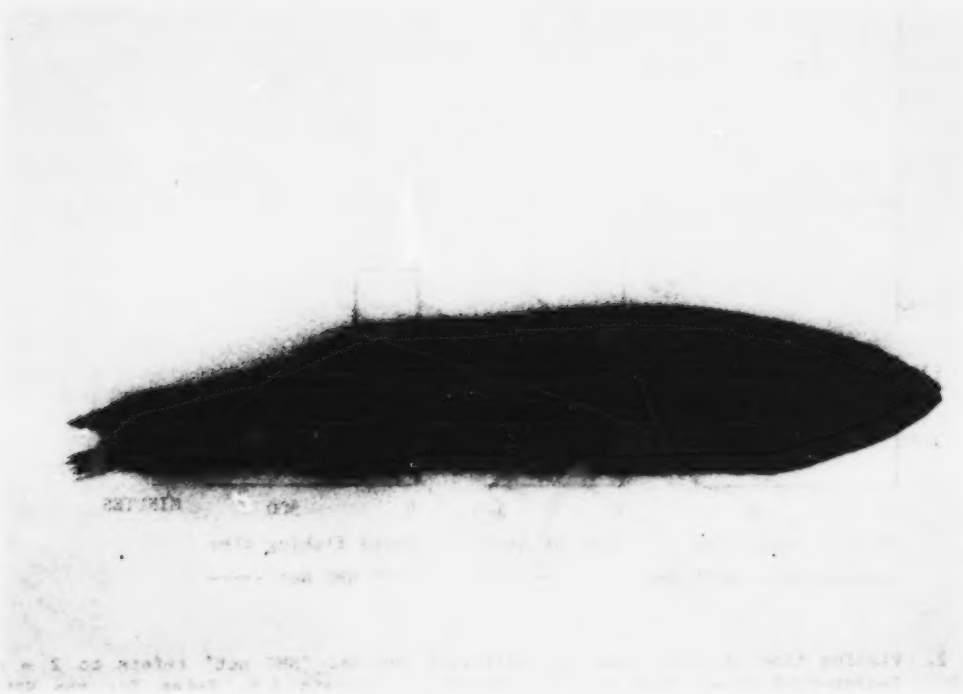

Figure 4. Photograph of Holtbyrnia macrops (106 mm S.L.) caught at Stn. P. (BCPM 979-11245).

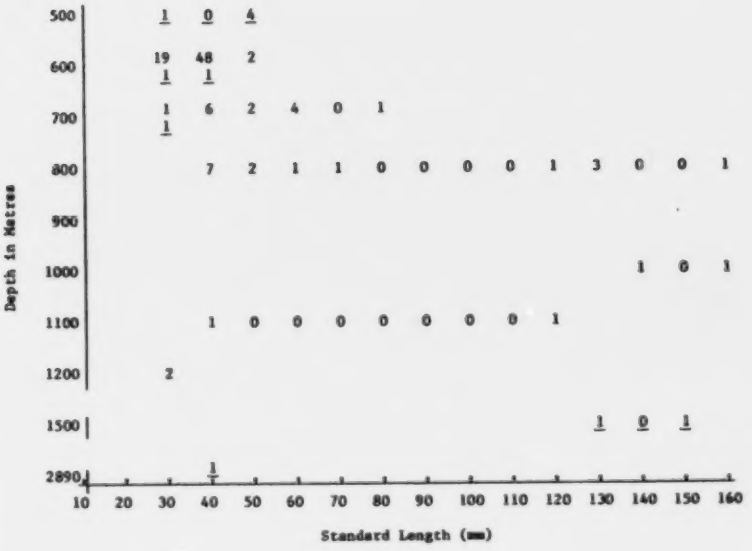

Figure 5. Depths at which Bathylagus milleri of different sizes were caught at Stn. P.

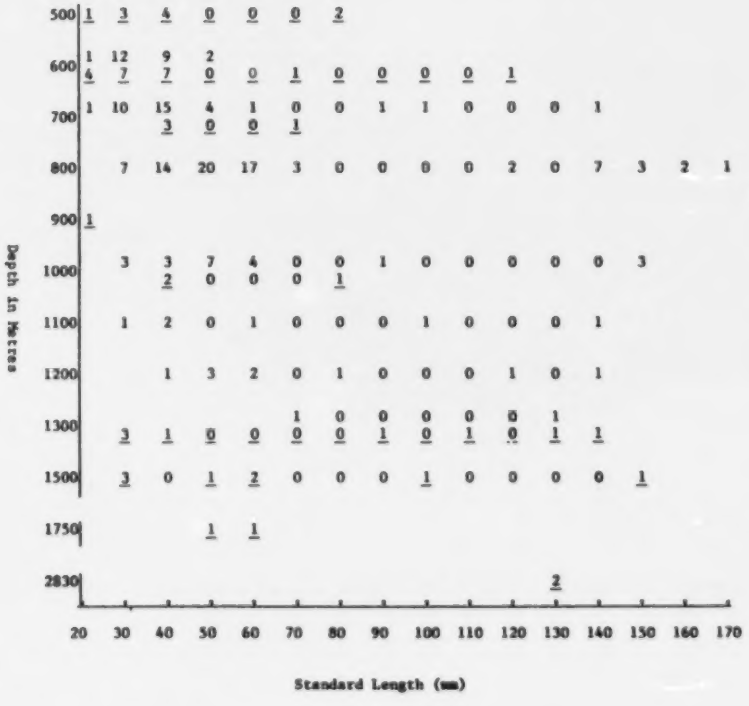

Figure 6. Depths at which Bathylagus pacificus of different sizes were caught at Stn. P.

Figure 7. Specimen of Macropinna microstoma (91 mm S.L.) caught at Stn. P. A - lateral view of right side (mirror image so as to show modified suborbital scale); B - dorsal view of head region (note left suborbital scale and bone missing). (BCPM 979-11252).

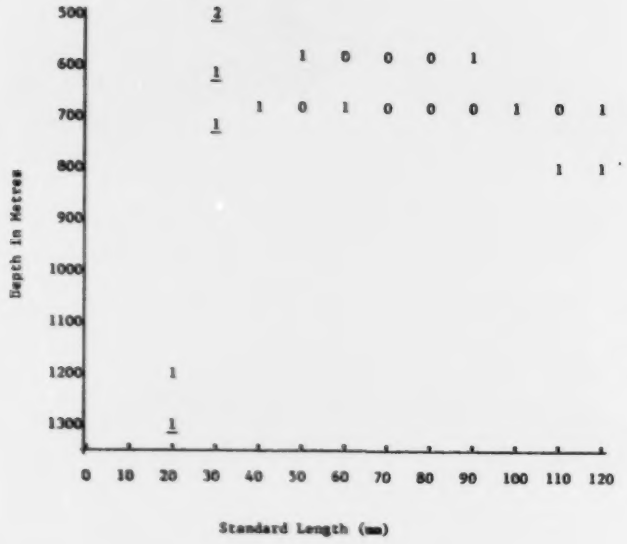

Figure 8. Depths at which Macropinna microstoma of different sizes were caught at Stn. P.

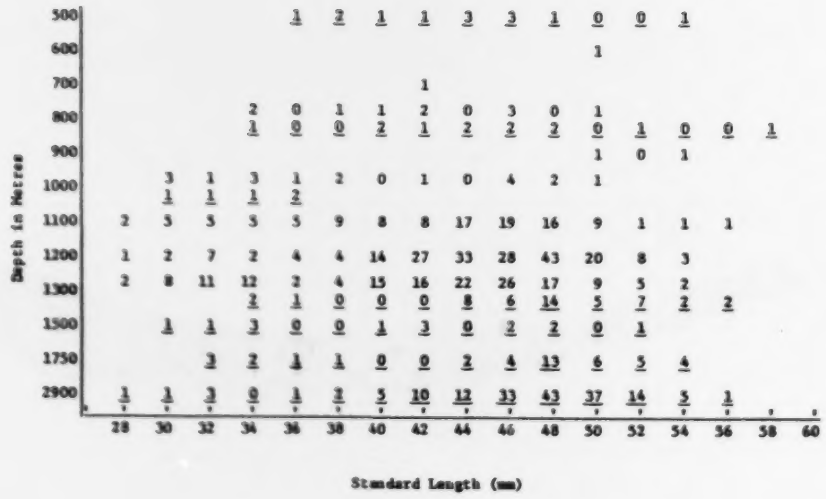

Figure 9. Depths at which Cyclothone pacifica of different sizes were caught at Stn. P.

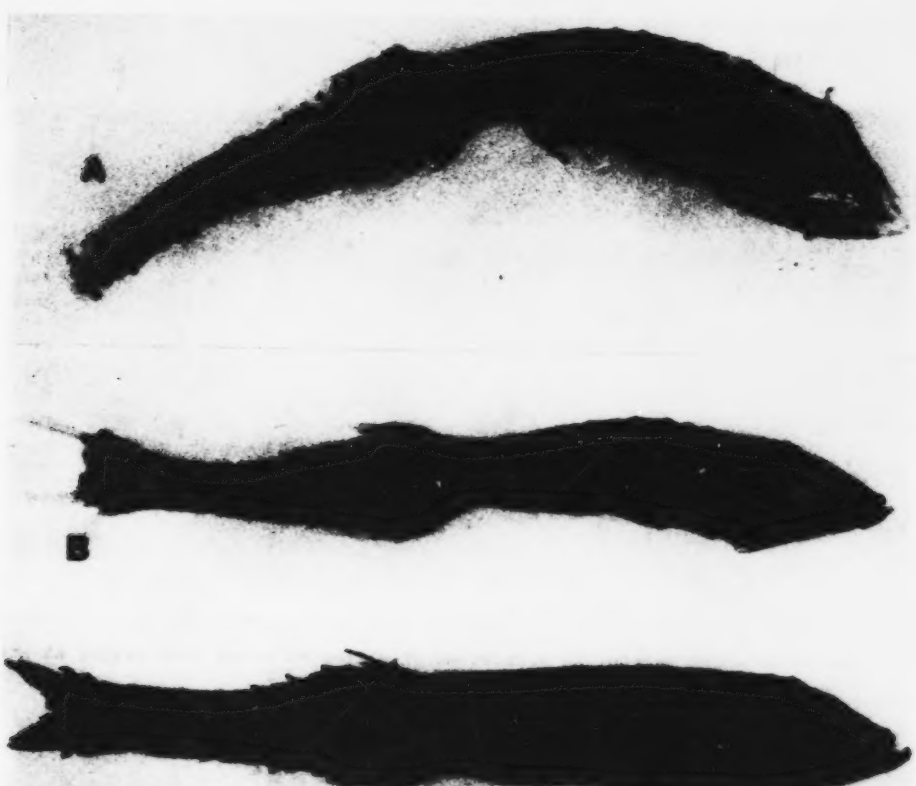

Figure 10. Specimens of Cyclothone caught at Stn. P.: A - C. signata (BCPM 979-11250, 35 mm S.L.); B - C. pallida (BCPM 979-11255, 61 mm S.L.); C - C. pacifica.

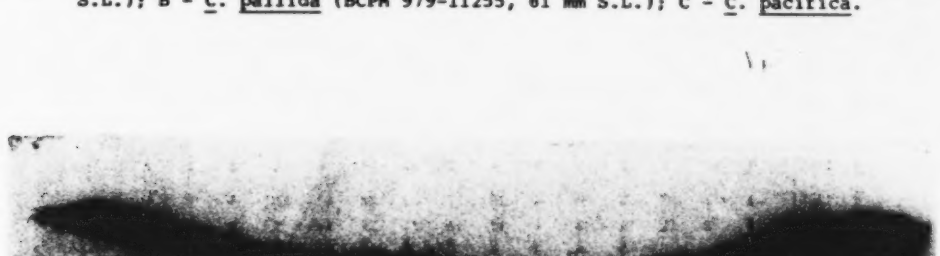

Figure 11. Specimen of Gonostoma gracilis (108 mm S.L.) caught at Stn. P. (BCPM 979-11250).

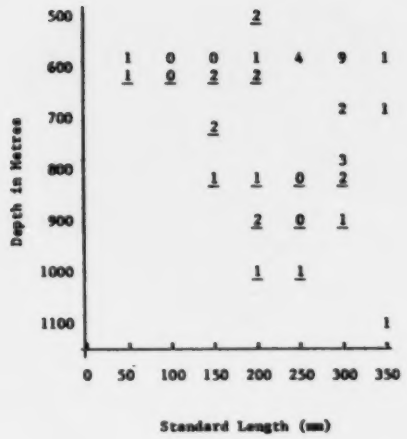

Figure 12. Depths at which Tactostoma macropus of different sizes were caught at Stn. P.

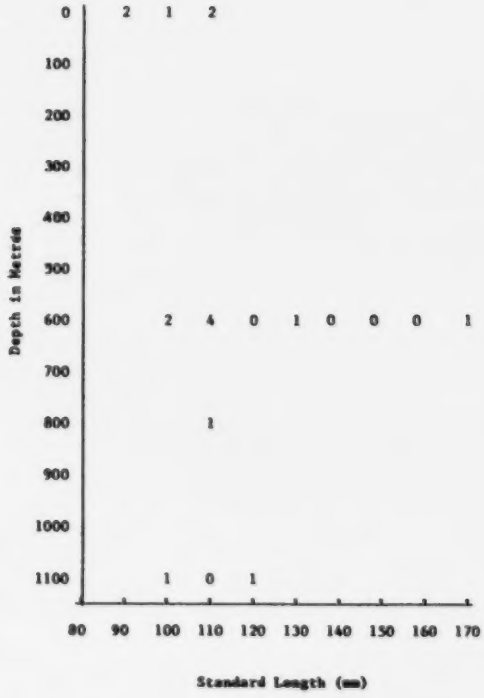

Figure 13. Depths at which Aristostomias scintillans of different sizes were caught at Stn. P.

Figure 14. Specimen of Malacosteus danae (142 mm S.L.) caught at Stn. P. (BCPM 979-11245).

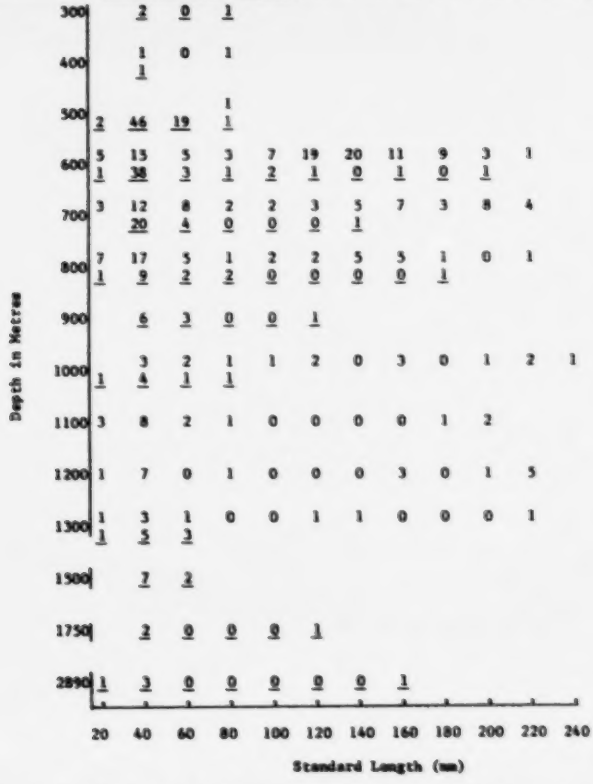

Figure 15. Depths at which Chauliodus macouni of different sizes were caught at Stn. P.

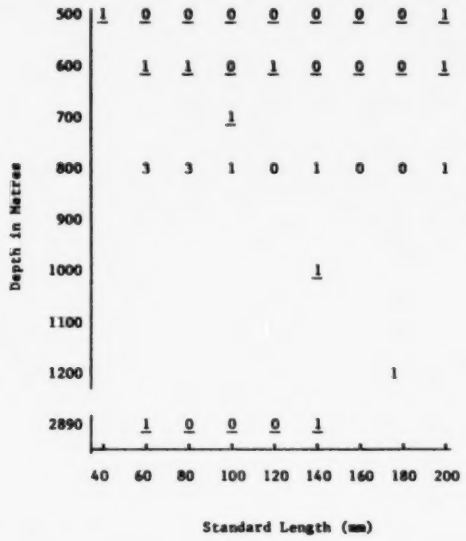

Figure 16. Depths at which Benthalbella dentata of different sizes were caught at Stn. P.

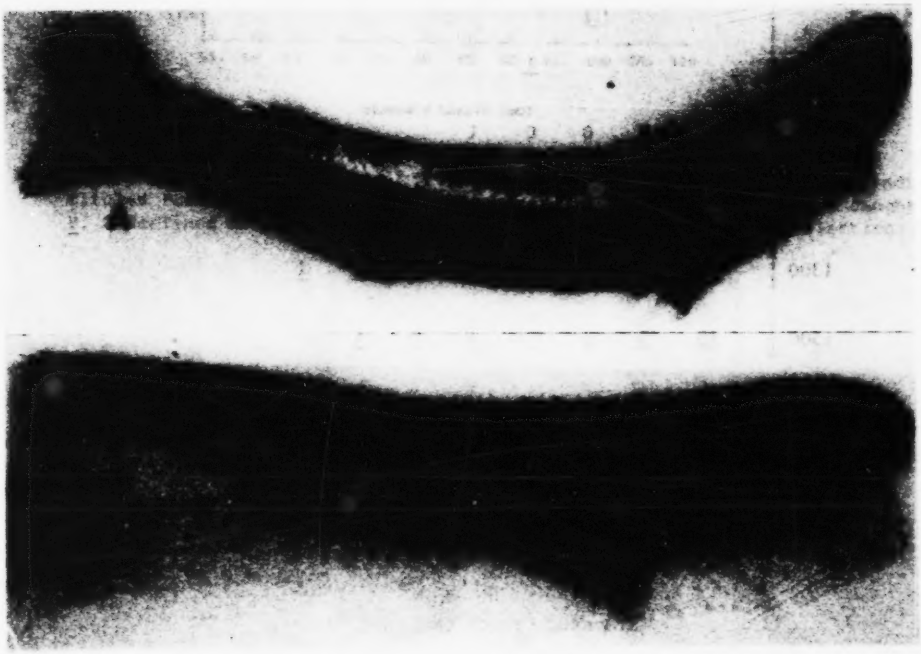

Figure 17. Specimens of Benthalbella linguidens (A - 258 mm S.L.; BCPM 979-11245) and B. dentata (B - 220 mm S.L.; BCPM 979-11245) caught at Stn. P.

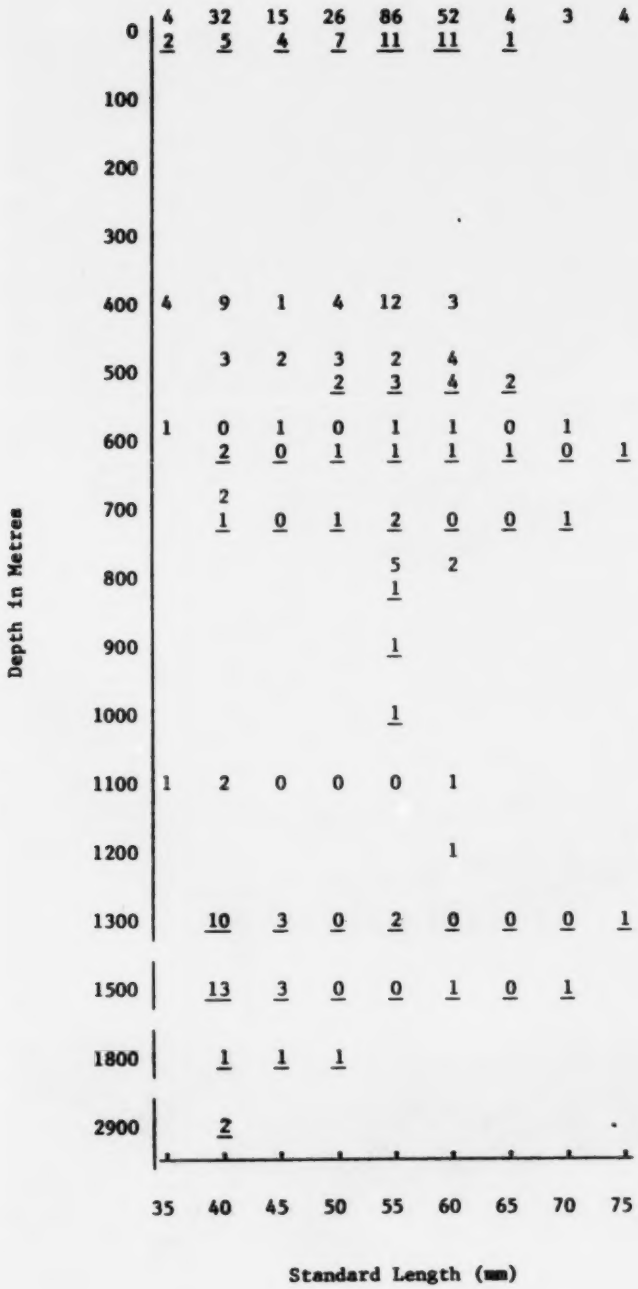

Figure 18. Depths at which Diaphus theta of different sizes were caught at Stn. P.

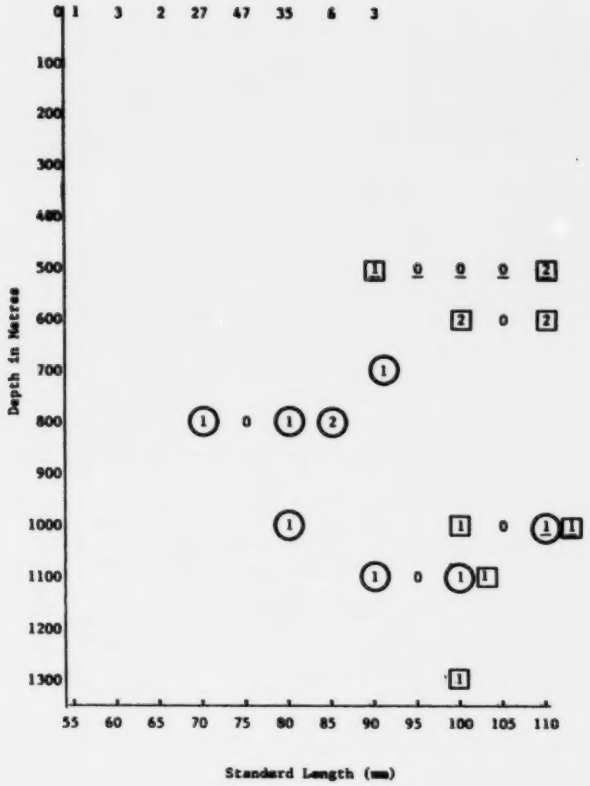

Figure 19. Depths at which Lampanyctus ritteri (uncoded numbers), L. regalis, (indicated by circled numbers), and L. jordani (squares) of different sizes were caught at Stn. P. Underlined numbers are NMC collections and others are BCPM collections.

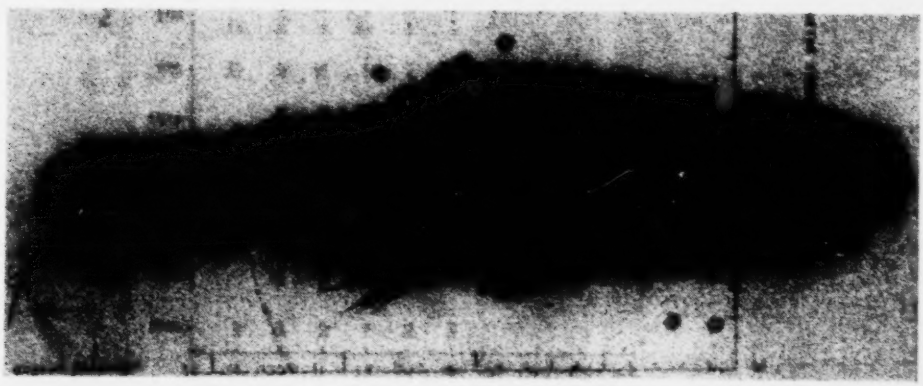

Figure 20. Specimen of Lampanyctus jordani from Stn. P.

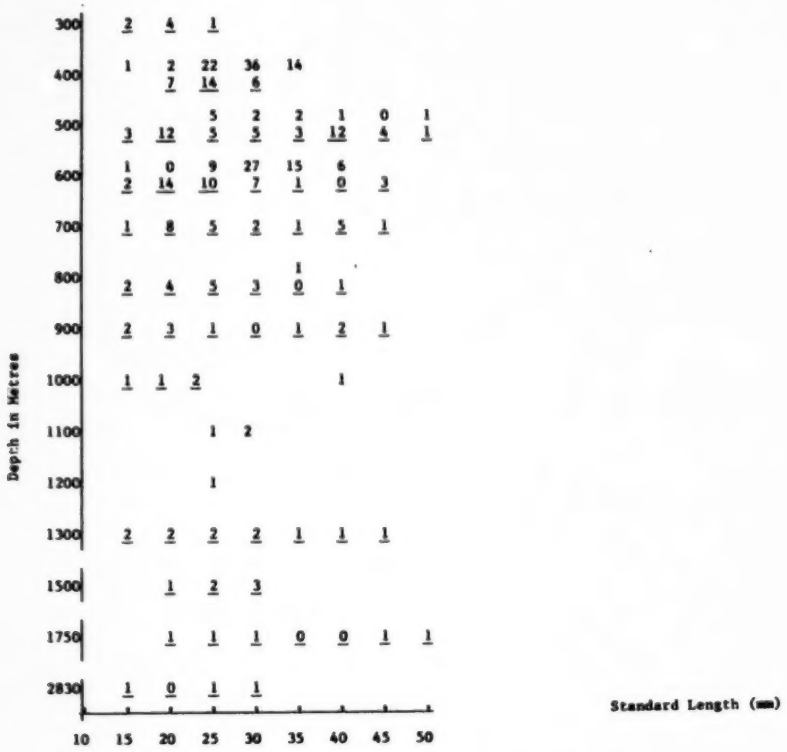

Figure 21. Depths at which Protomyctophum thompsoni of different sizes were caught at Stn. P.

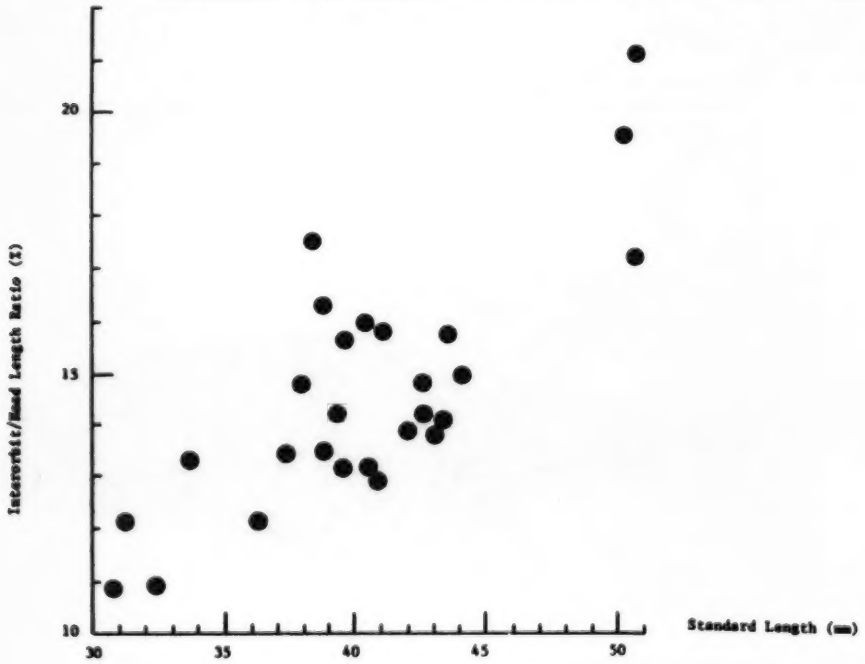

Figure 22. Graph showing increase in relative interorbital width with increased standard length of Protomyctophum thompsoni caught near Stn. P.

Figure 23. Photographs showing relative changes in eye and interorbit morphology of Protomyctophum thompsoni from Stn. P. Horizontal lines on right indicate margin of interorbit in juvenile (A) and adult (B).

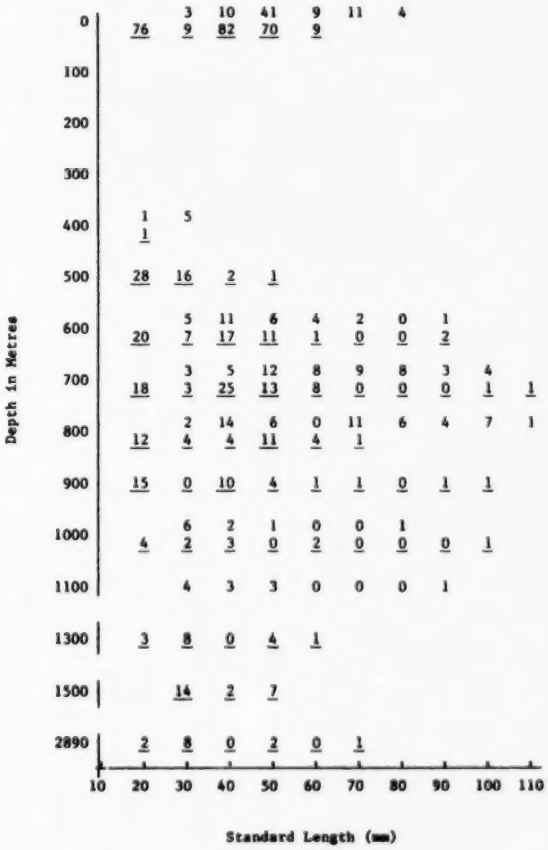

Figure 24. Depths at which Stenobrachius leucopsarus of different sizes were caught at Stn. P.

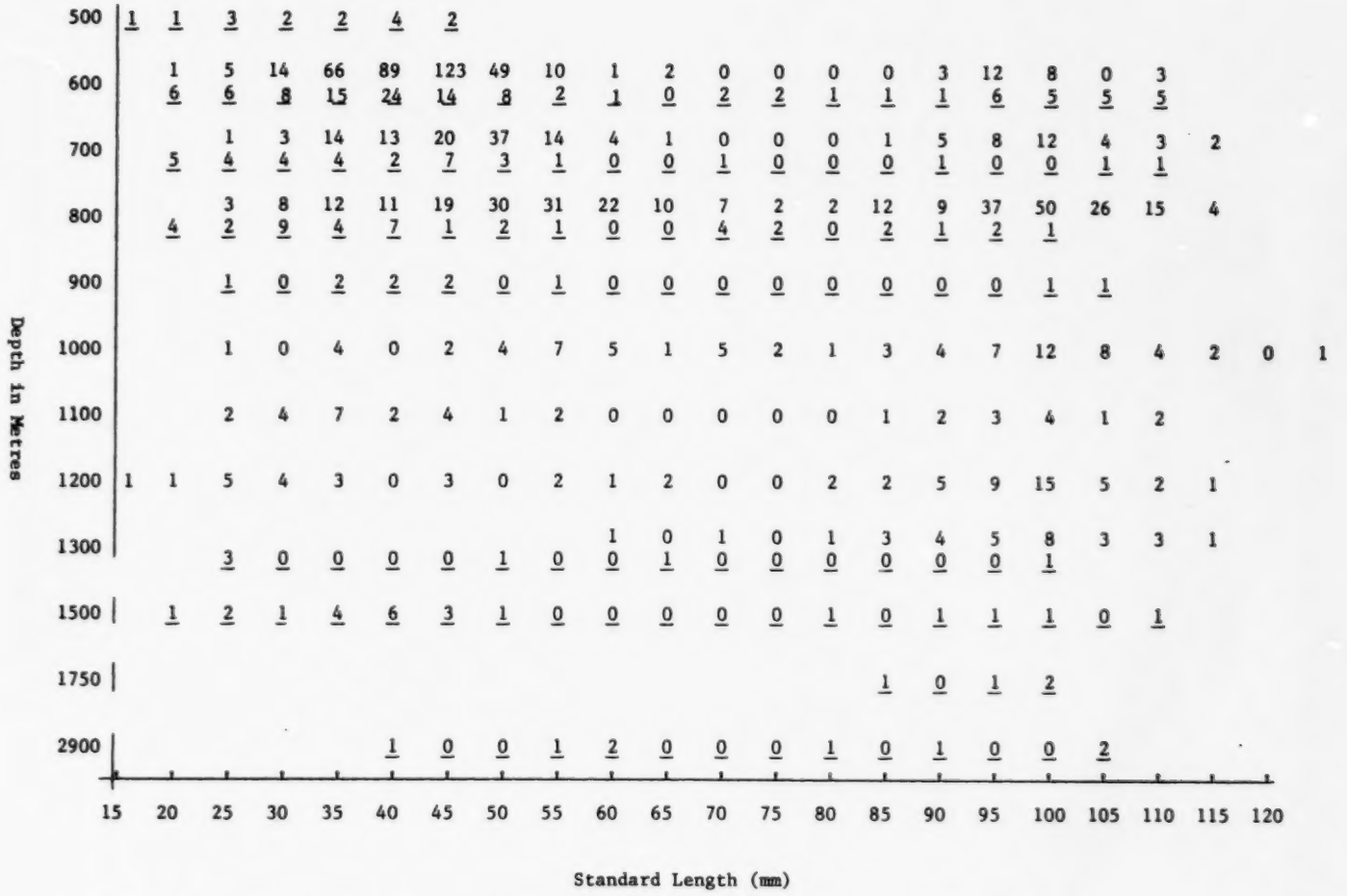

Figure 25. Depths at which Stenobrachius nannochir of different sizes were caught at Stn. P.

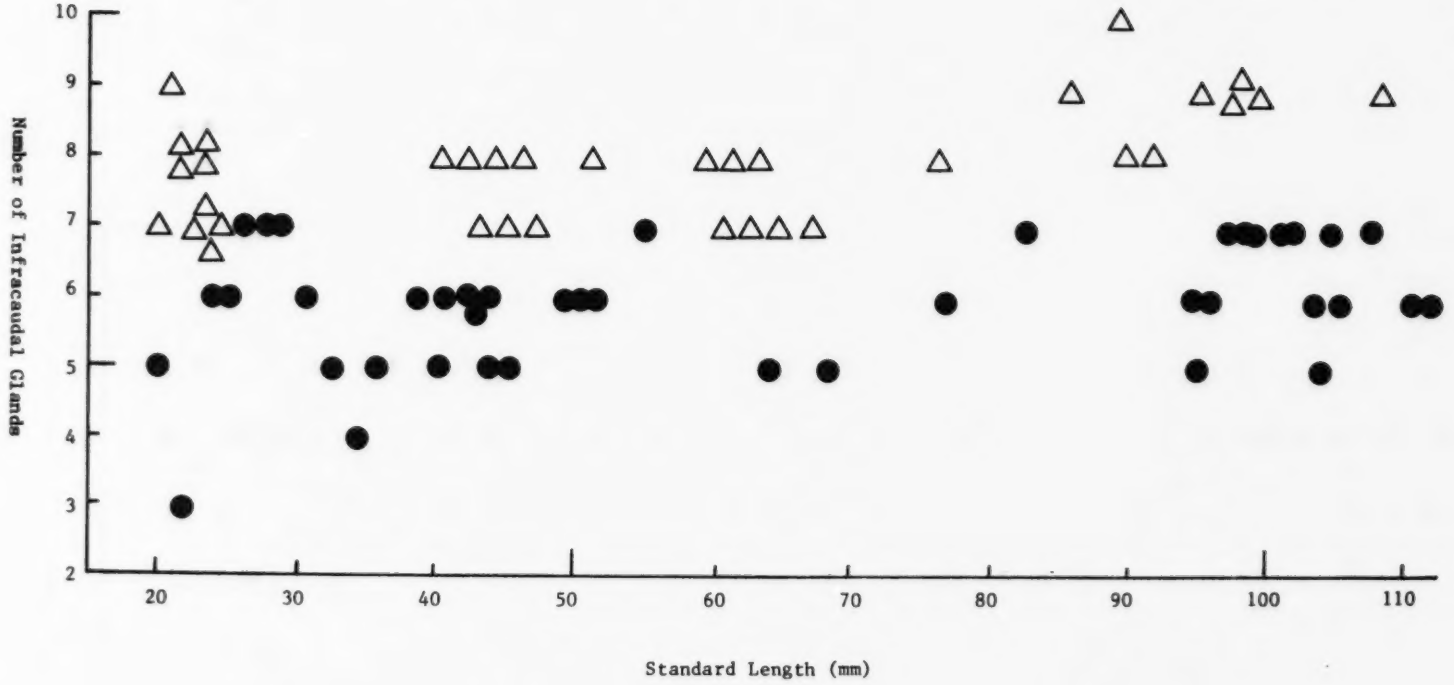

Figure 26. Number of scales in series occupied by infracaudal luminous glands in Stenobrachius leucopsarus (triangles) and S. nannochir (dark circles) from Stn. P.

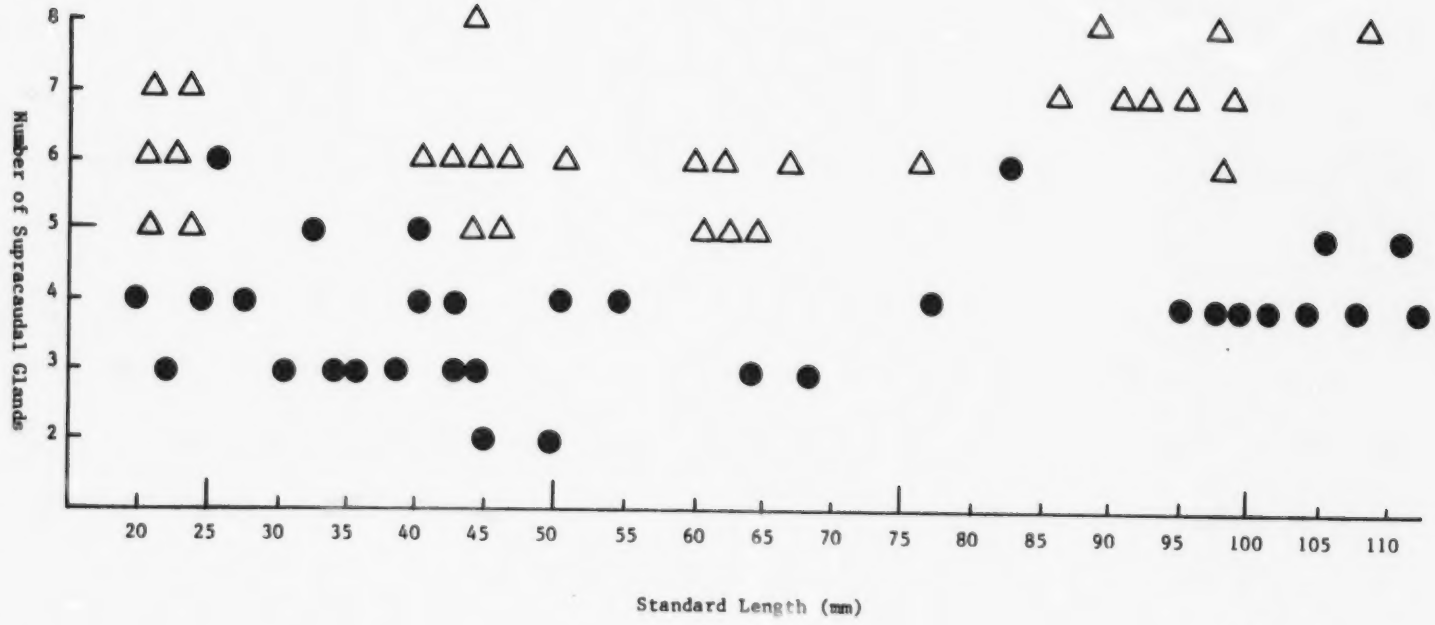

Figure 27. Number of scales in series occupied by supracaudal luminous glands in Stenobrachius leucopsarus (triangles) and S. nannochir (dark circles) from Stn. P.

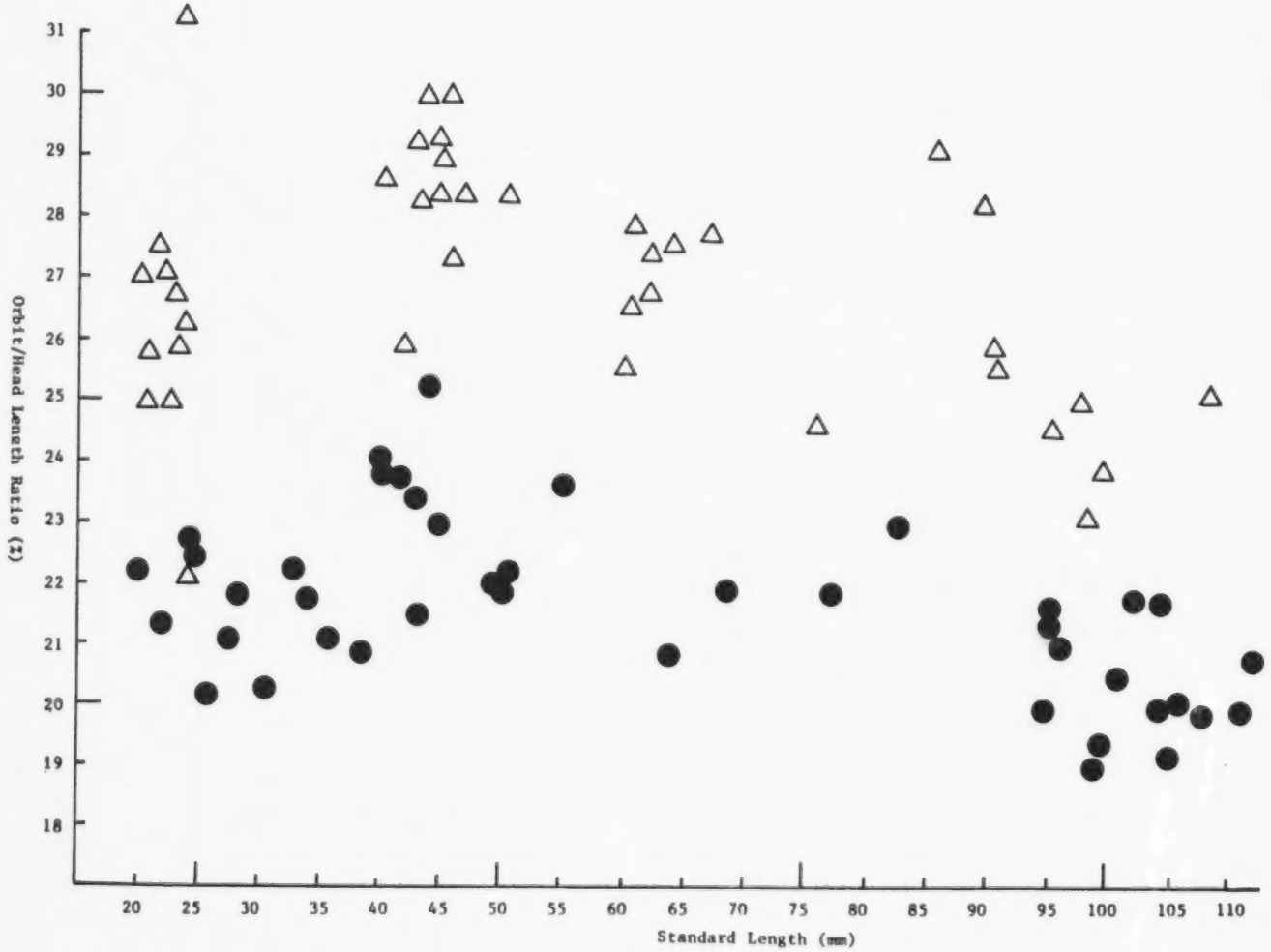

Figure 28. Relative size of orbit at different sizes of Stenobrachius leucopsarus (triangles) and S. nannochir (dark circles) from Stn. P.

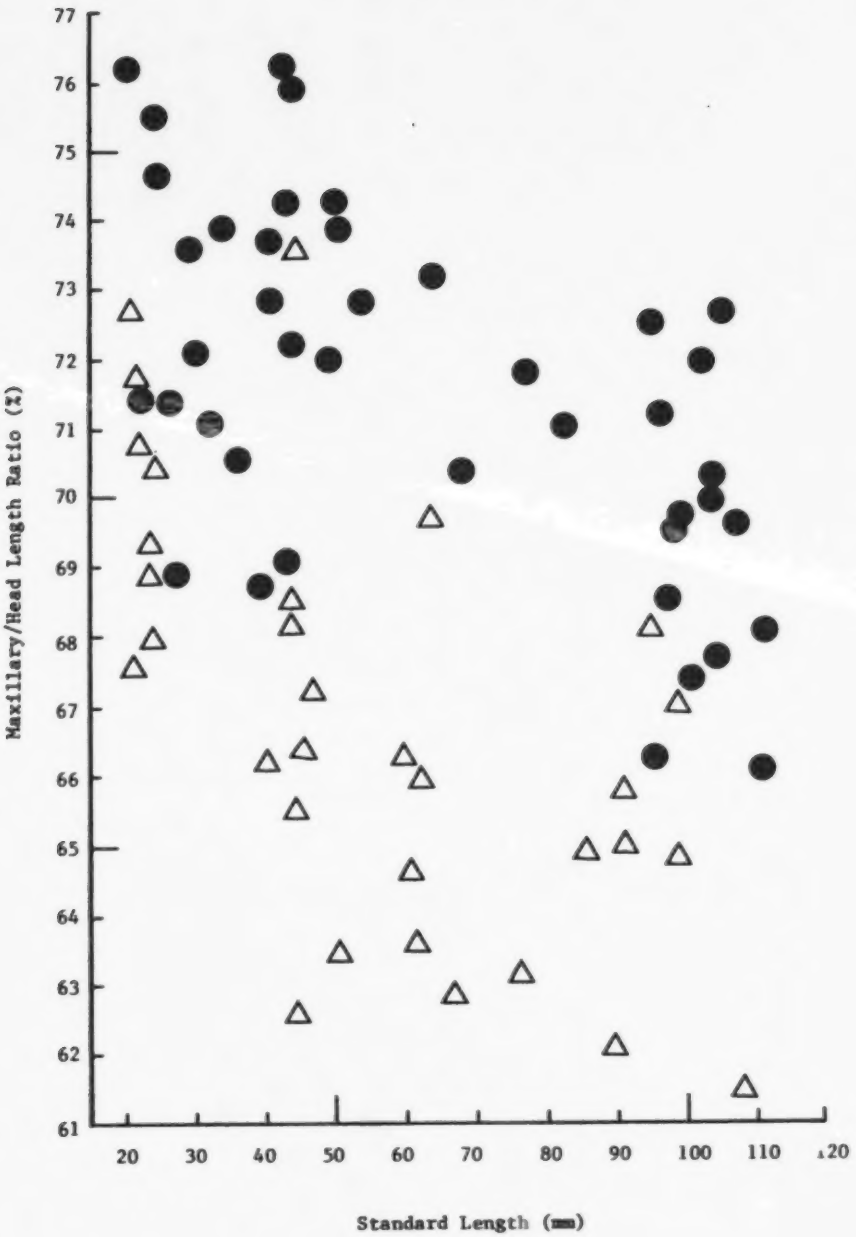

Figure 29. Relative maxillary length at different sizes of Stenobrachius leucopsarus (triangle) and S. nannochir (dark circles) from Stn. P.

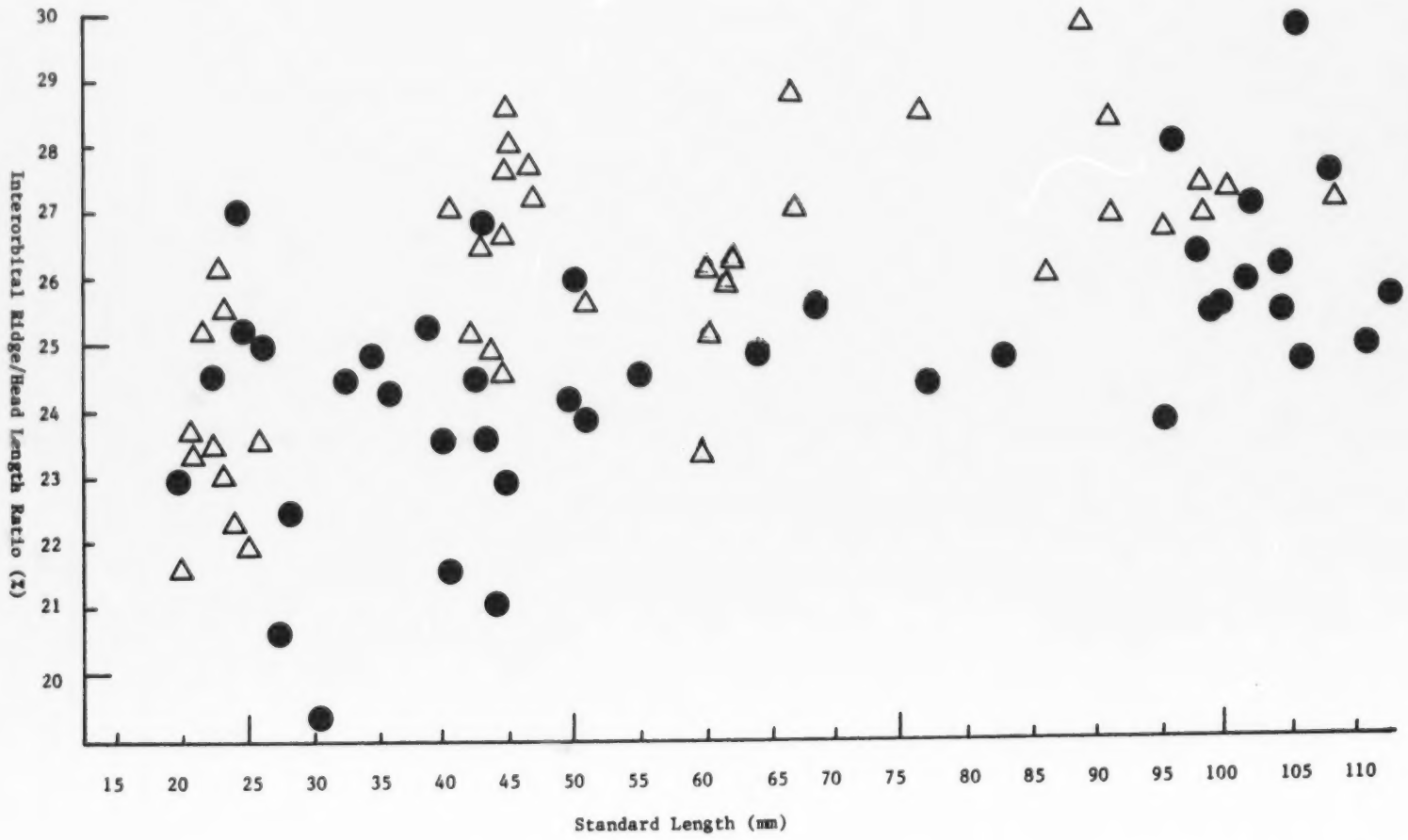

Figure 30. Relative interorbital width at different sizes of Stenobrachius leucopsarus (triangles) and S. nannochir (dark circles) from Stn. P.

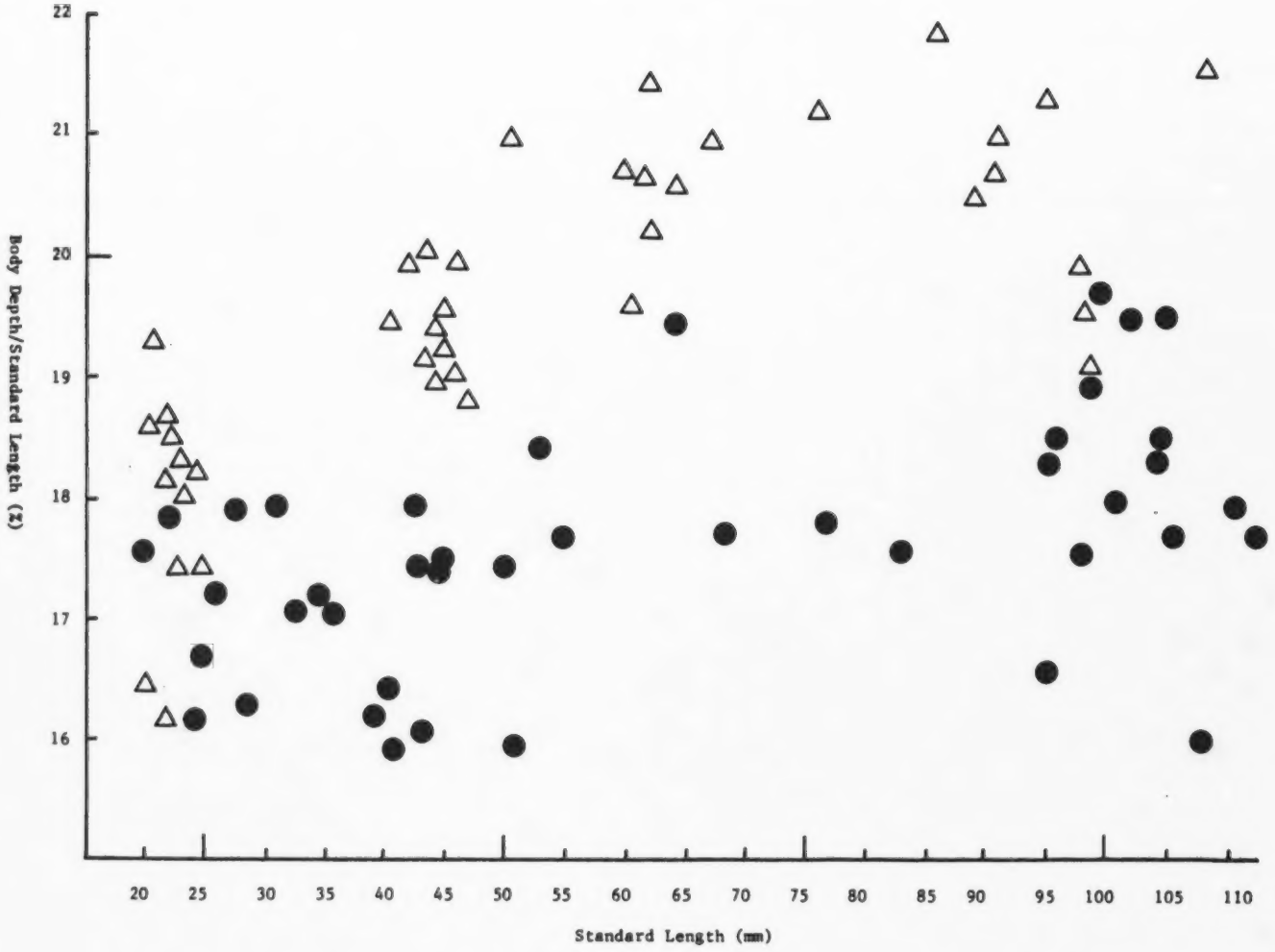

Figure 31. Relative body depth at different sizes of Stenobrachius leucopsarus (triangles) and S. nannochir (dark circles) from Stn. P.

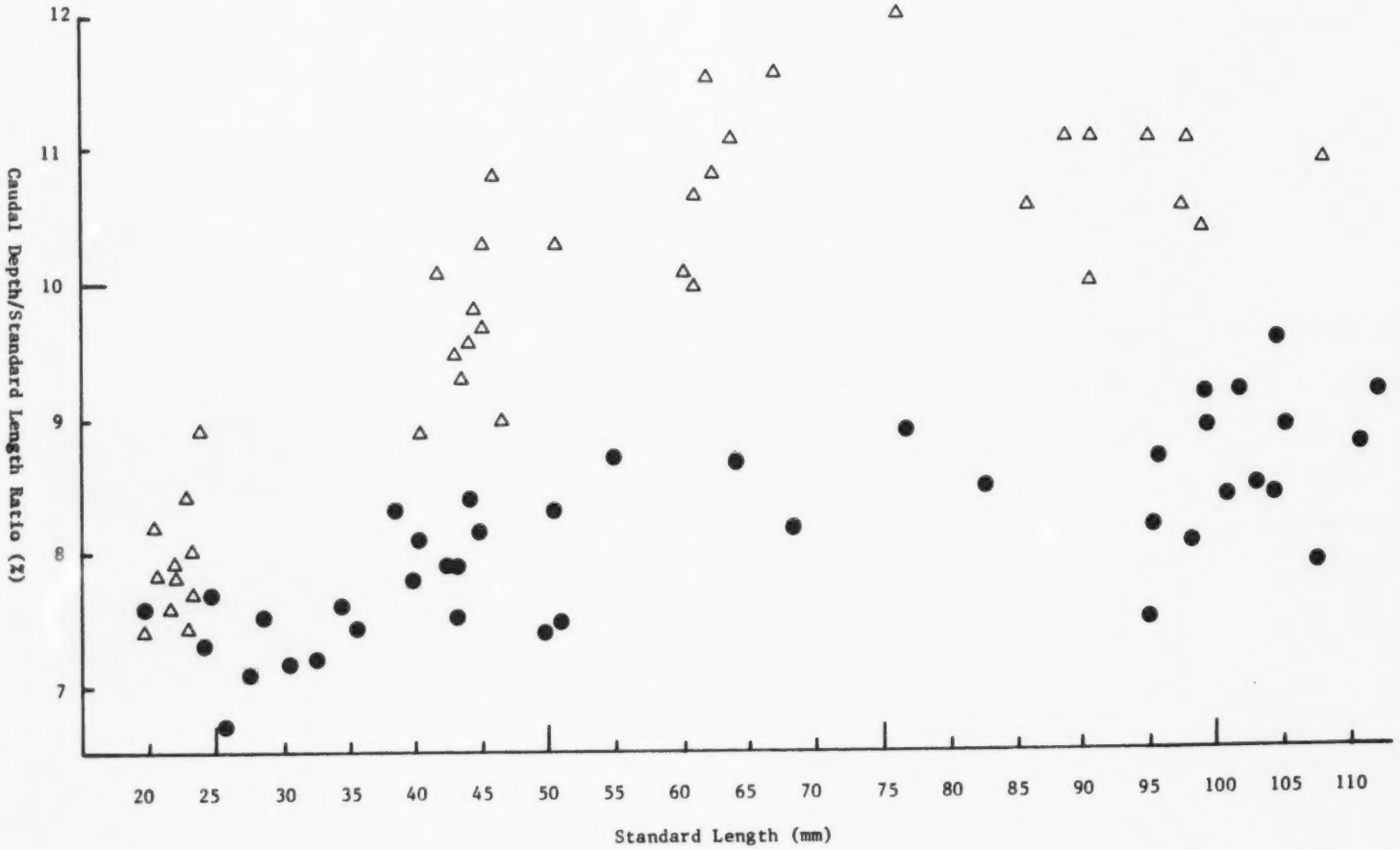

Figure 32. Relative caudal peduncle depth at different sizes of Stenobrachius leucopsarus (triangles) and S. nannochir (dark circles) from Stn. P.

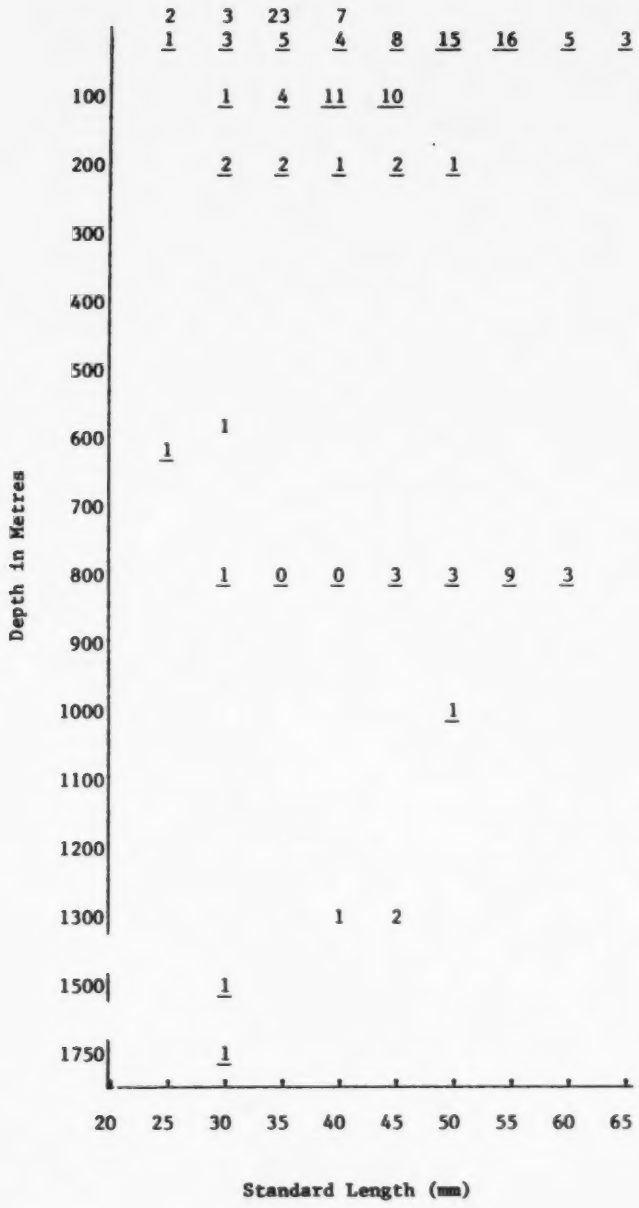

Figure 33. Depths at which Tarletonbeania crenularis of different sizes were caught at Stn. P.

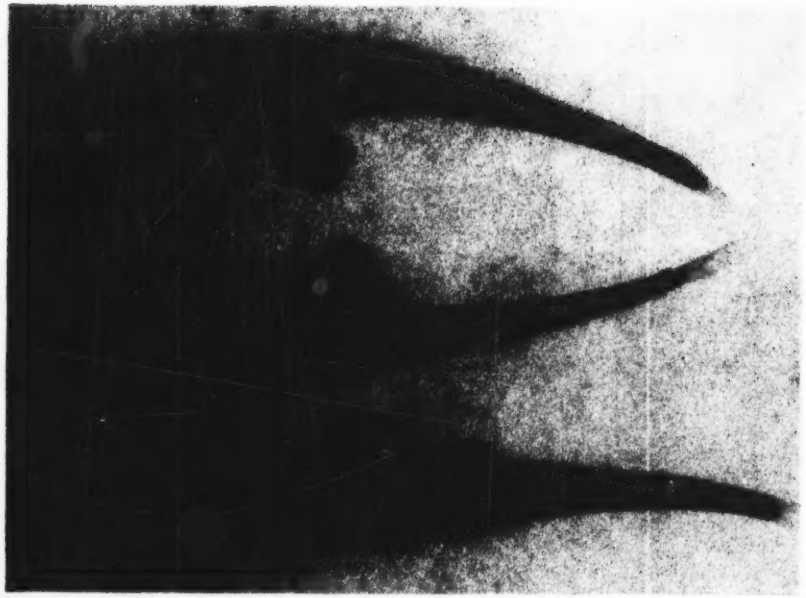

Figure 34. A - Tarletonbeania crenularis crenularis, B - possible hybrid Tarltonbeania crenularis crenularis and Tarltonbeania crenularis taylori, C - Tarltonbeania crenularis taylori, D - sketches of respective infracaudal glands.

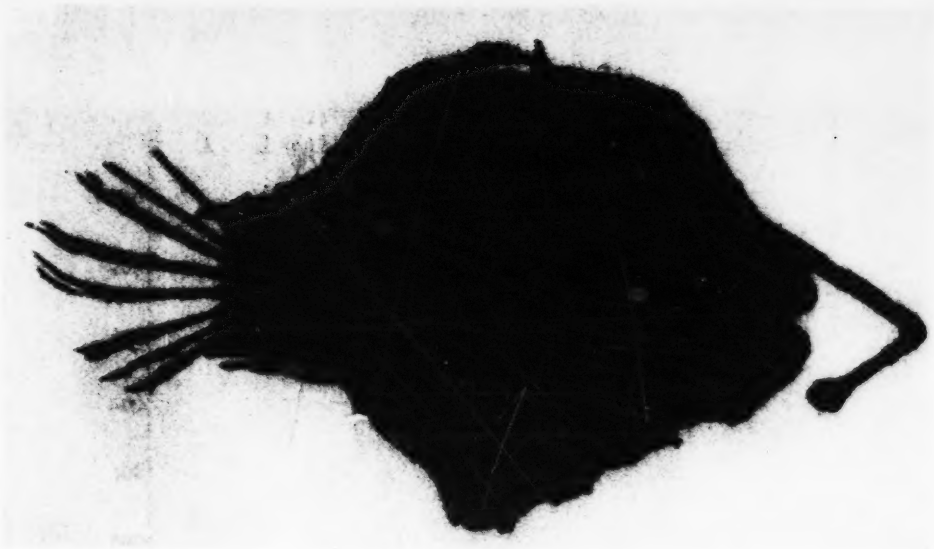

Figure 35. Specimen of Oneirodes bulbosus (41 mm S.L.) caught at Stn. P. (BCPM 979-11239).

Figure 36. Specimen of Oneirodes thompsoni (37 mm S.L.) caught at Stn. P. (BCPM 979-11239).

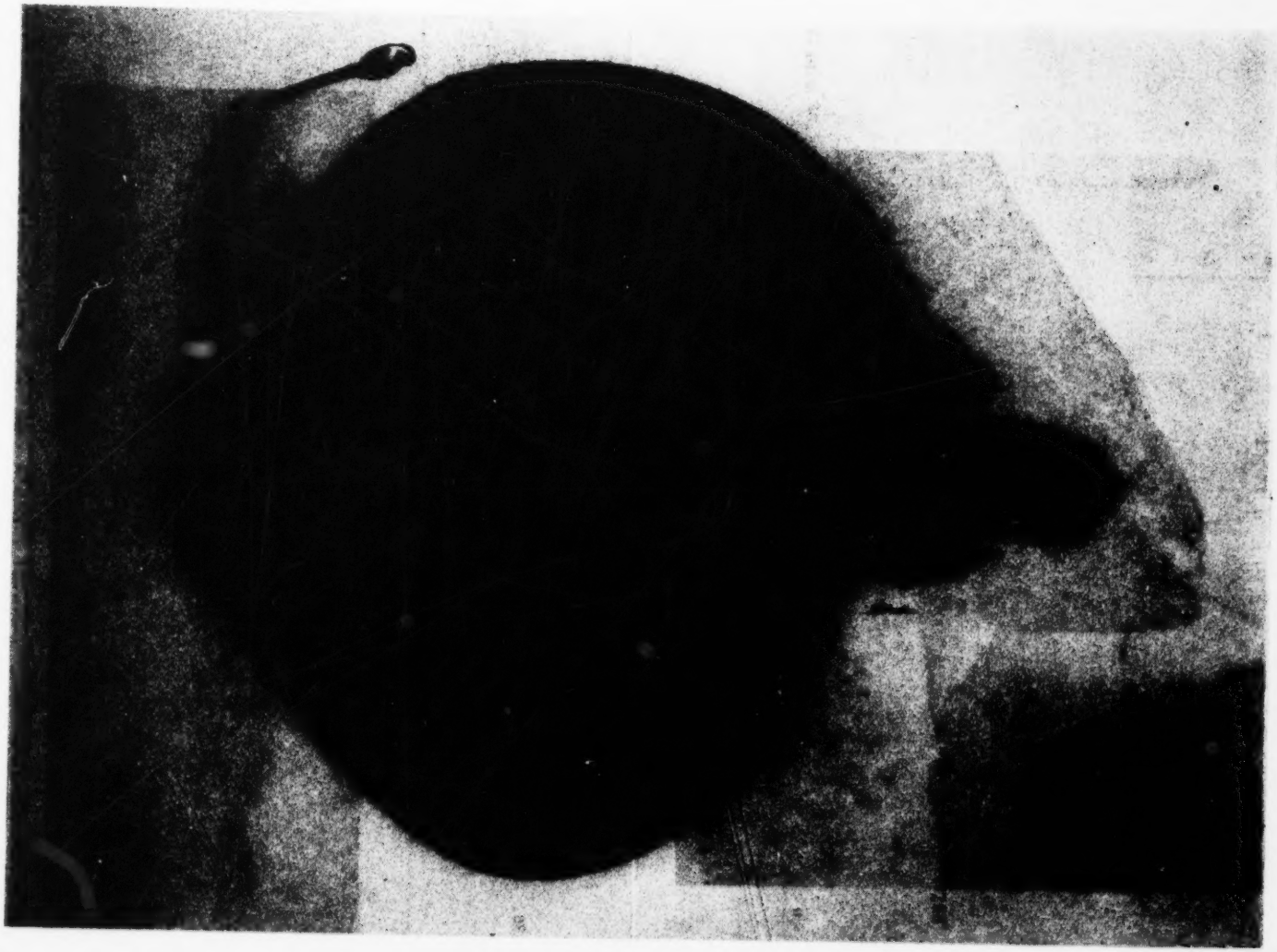

Figure 37. Illustration of Chaenophryne melanorhabdus drawn by Kathy Shuster (65 mm S.L.) caught 80 mi. west of Cape Flattery (BCPM 972-64).

Figure 38. Specimen (from Kodachrome slide) of Gyrinomimus sp. caught at Stn. P.

Figure 39. Specimen of Halargyreus johnsoni (195 mm S.L.) caught at Stn. P. (NMC 76-0031).

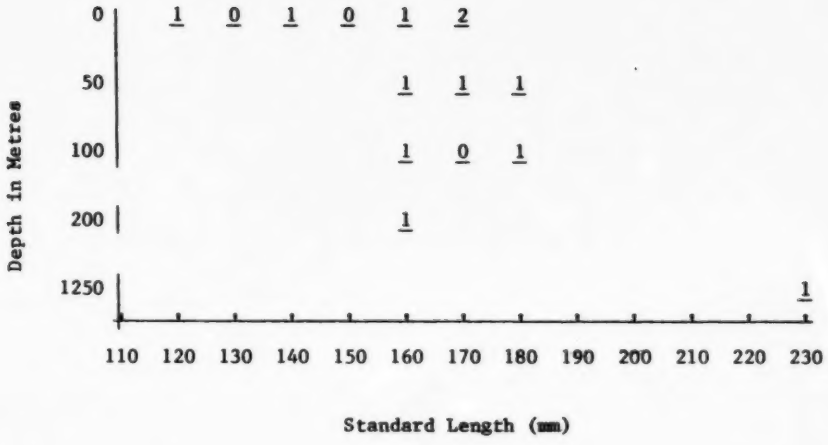

Figure 40. Depths at which Cololabis saira of different sizes were caught at Stn. P.

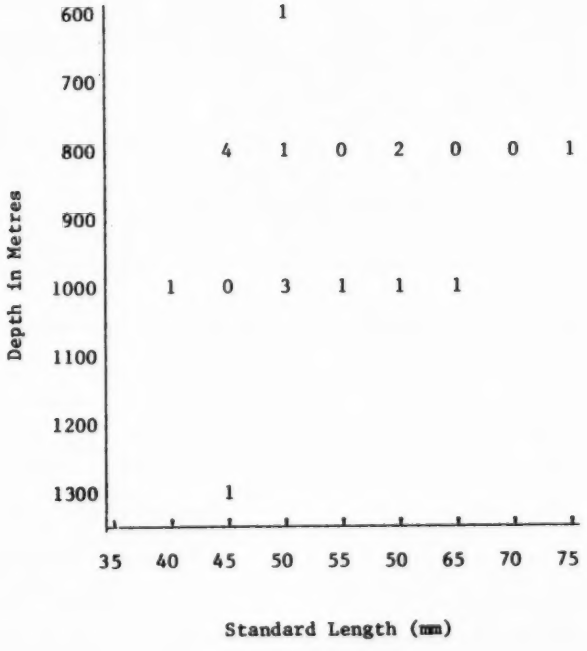

Figure 41. Depths at which Melamphaes lugubris of different sizes were caught at Stn. P.

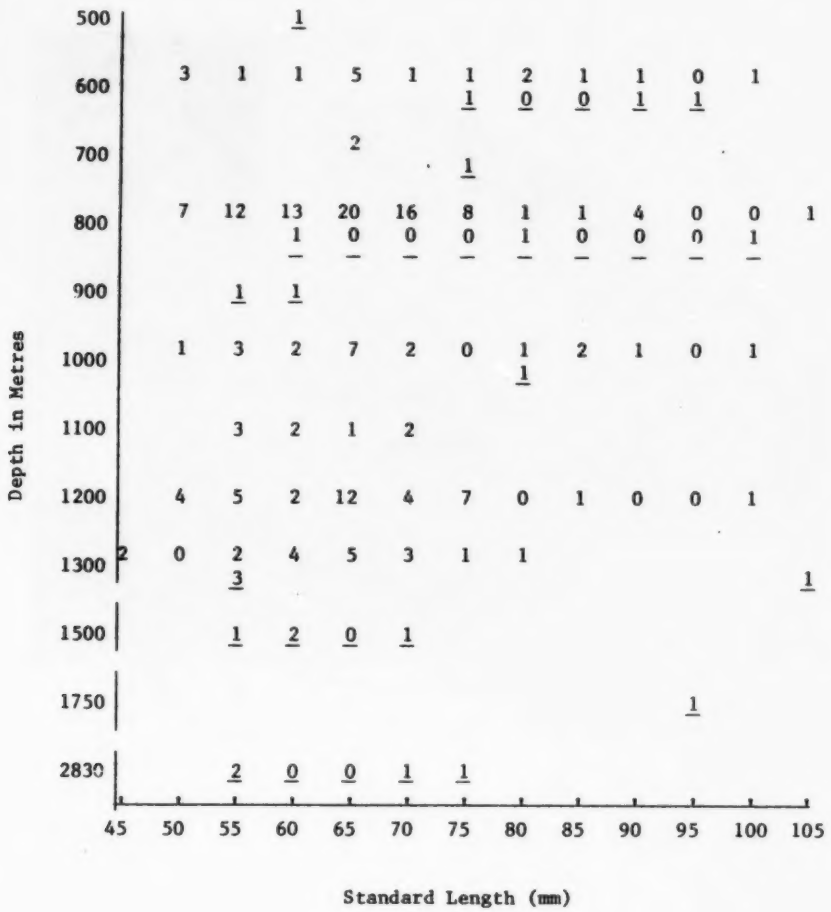

Figure 42. Depths at which Poromitra crassiceps of different sizes were caught at Stn. P.

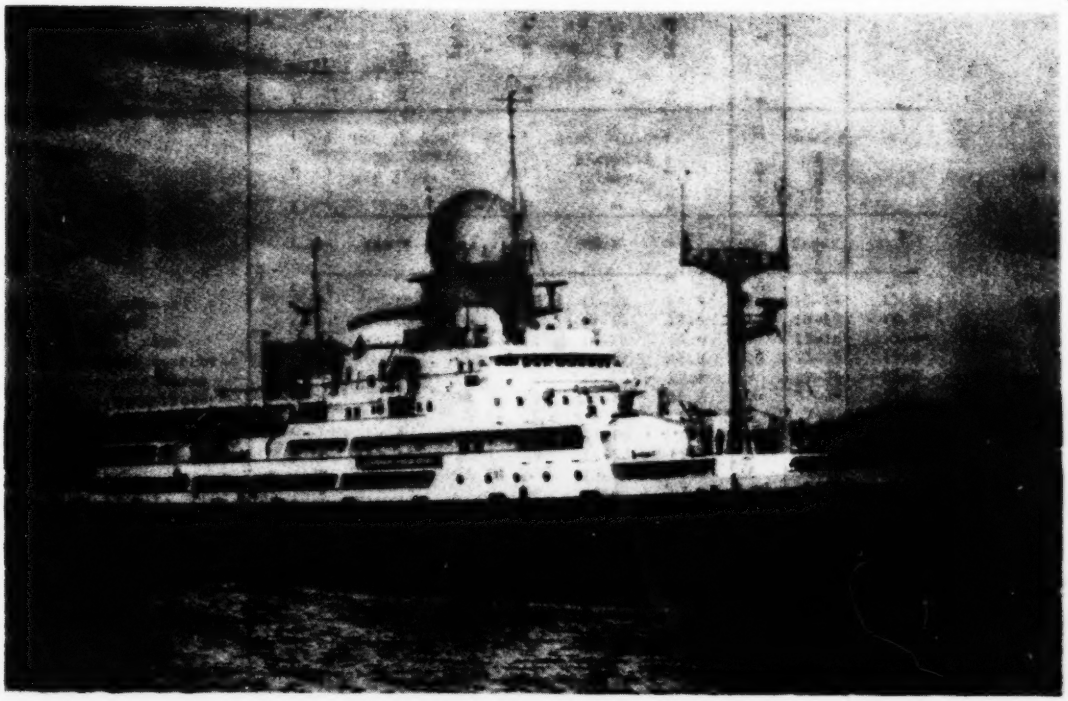

Figure 43. Weathership Quadra leaving Esquimalt Harbour.

TABLES

Table 1. Counts for Benthalbella linguidens

	BCPM 979-1245	UV uncatalogued
No. specimens	2	1
No. dorsal rays	8	9
No. anal rays	28-29	26
No. pectoral rays	22-24	24
No. pelvic rays	9	9
No. lat. line scales	63-65	67
No. scale rows between dorsal origin and lateral line	11	-
No. vertebrae	-	62
Standard length	258-270 mm	181 mm

Table 2. Fin and vertebral counts of Lestidiops

Region	Dorsal							Anal									Pectoral					Total Vertebrae										
	9	10	11	12	13	N	$\bar{X}$	26	27	28	29	30	31	32	33	N	$\bar{X}$	10	11	12	N	$\bar{X}$	84	85	86	87	88	89	90	91	92	N	$\bar{X}$
Stn. P. to 52°17'N & 147°24'W	-	1	3	8	1	13	11.7	1	3	7	2	-	-	-	-	13	27.28	1	10	2	13	11.08	-	-	-	1	2	3	4	1	-	11	89.18
48°34'N 144°17'W	-	-	-	2	-	2	12.0	-	1	1	-	-	-	-	-	2	27.5	-	-	-	-	-	-	-	-	-	-	-	2	-	-	2	90.0
Off Queen Charlotte Sound and Islands BC	-	-	2	5	2	9	12.0	1	4	7	2	-	-	-	-	14	27.71	-	3	-	3	11.0	-	-	-	2	10	4	2	-	-	18	88.33
Off Vancouver Island	-	-	-	2	-	2	12	-	2	-	-	-	-	-	-	2	27.0	-	2	-	2	11.0	-	-	1	-	1	-	-	-	-	2	87.0
elongatum Ege (1933)[1]	-	-	1	9	2	12	12.08	-	2	6	4	-	-	-	-	12	28.16	-	-	-	-	-	-	-	-	-	3	3	3	1	-	10	89.2
ringens from Harry 1966	-	-	*	*	-	-	?	*	*	*	-	-	-	-	-	-	?	-	-	-	-	-	*	*	*	*	-	-	-	-	-	?	-
Hart (1973)	*	*	*	*	-	-	?	-	?	*	*	*	*	*	*	-	?	-	*	*	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 3. Counts of Lampanyctus jordani

	NMC 69-424 426, 427 off Japan			BCPH 980-597 Aleutian Islands			Stn. P.		
	N	RANGE	$\bar{X}$	N	RANGE	$\bar{X}$	N	RANGE	$\bar{X}$
Dorsal rays	8	11-12	11.8	9	11-13	11.9	7	13-14	13.8
Anal rays	8	16-20	18.1	8	18-19	18.5	7	18-19	18.4
Pectoral rays	7	14-16	15.0	9	14-16	14.9	5	15-16	15.4
Precaudal vertebrae	8	16	16.0	9	15-17	16.0	7	15-16	15.6
Caudal vertebrae	8	22-24	22.8	9	22-24	22.8	7	22-24	23.0
Total vertebrae	8	38-40	38.8	9	38-39	38.8	7	37-39	37.6
AOa photophores	8	6-7	6.8	9	6-8	6.9	5	7-8	7.4
AOp photophores	6	8-9	8.8	9	7-10	8.8	5	8-10	8.8
Total AO photophore	6	15-16	15.5	9	14-17	15.7	5	16-17	16.2
Gill rakers, lower limb	8	14-17	15.2	9	13-16	15.2	5	14-16	15.4
Gill rakers, upper limb	8	7	7.0	9	6-8	7.6	5	7-8	7.4
Total gill rakers (raker at angle of arch added)	8	22-25	23.4	9	21-25	23.6	5	23-25	23.8
Lateral-line scale pockets	6	39-40	40.0	8	40-41	40.1	5	39-41	40.2

Table 4. Counts of Lampanyctus regalis

	Stn. P.	off southern British Columbia
No. specimens	6 (maximum)	11 (maximum)
dorsal rays	15 (2 specimens)	14-17 ($\bar{X}$=15.5)
anal rays	17-18 (2 specimens)	16-19 ($\bar{X}$17.5)
pectoral rays	12 (2 specimens)	11-14 ($\bar{X}$=13.0)
AOa photophores	7 (2 specimens)	6-8 ($\bar{X}$=6.8)
AOp photophores	7-8 (2 specimens)	7-8 ($\bar{X}$=6.8)
total AO photophores	14-15 (2 specimens)	13-15 ($\bar{X}$=14.3)
gill rakers	4-5+1+11-12=16-18	5-6(5.2)+1+11-12(11.6)=17-19 (17.9)
total vertebrae	36-37 ($\bar{X}$=36.8, 5 specimens)	

Table 5. Counts of Lampanyctus ritteri

	N	RANGE	$\bar{X}$
dorsal rays	17	13-14	13.7
anal rays	17	17-19	17.9
pectoral	12	11-12	11.6
AOa photopheres	13	6-8	7.1
AOp photophores	13	8-9	8.4
Total AO photopheres	13	15-16	15.5
gill rakers	13	11-12+1+5	11.0+1.0+5.0
vertebrae	22	15-16+21-22=36-38	15.1+21.1=37.0

Table 6. Counts and Measurements of Notoscopelus

	N. japonicus specimen NMC 69-424	N. japonicus specimen NMC 69-334	N. resplendens Wisner 1974	N. japonicus (=N. elongatus of Bolin 1939)	N. japonicus (=N. elongatus Clemens & Wilby 1961)	Notoscopelus ??? Hart 1973
Standard lengths	109 mm	124 mm	35-78 mm	110-113 mm	135 mm	?
Dorsal	22	22	21-23	21	21	15-17
Anal	19	19	18-20	19	19	18-19
Pectoral	11	11	11-13	11-12	---	13
Total vertebrae	41	41	35-38	---	---	---
Lateral line scales	43+2	42+2	---	---	41-42	41-42
Gill rakers	18+1+9	17+1+9	12-14-1+ 6-7	14-17+1+7-8	---	---
AOa photophores	8	9	8-9			
AOp photophores	7	?	4-5	9	9	7-9
Total AO photophores	15	?	13-14	6-7	6-7	6-7
POL photophores	2	2	2	15-16	15-16	---
Prc photophores	2+2	2+2	2+1	2	2	confused? 3-5+1
				2+2	2+2	
Following expressed as thousandths of standard length:						
Head length	260	234	290-320	264-266		
Upper jaw length	191	180	206-231	189-195		
Prepectoral length	274	242	296-329	273-278		
Prepelvic length	401	400	410-436	413-414		
Pre-anal length	552	558	571-592	574-587		
Predorsal length	411	368	414-440	393-423		
Pre-adipose length	880	765	792-813	786-837		
Dorsal to pelvic origins	181	180	190-212	141-156		
Dorsal to anal origins	250	242	254-284	236-241		
Length of dorsal base	311	289	296-323	266-268		
Length of anal base	215	207	214-233	210-211		
Caudal peduncle depth	93	81	88-106	76- 90		
Pelvic fin length	133	---	138-160	---		

Table 7. Counts of Protomyctophum thompsoni

	Large specimens, Eastern Aleutians BCPM 980-572			Small specimens, Station Papa BCPM		
	N	$\bar{X}$	RANGE	N	$\bar{X}$	RANGE
Dorsal	21	11.7	11-13	26	11.7	11-12
Anal	21	22.3	21-24	26	22.6	21-24
Pectoral	11	15.9	15-17	12	15.9	15-17
Total vertebrae	27	38.2	38-39	24	38.1	37-39
AO photophores	12	16.0	15-17	12	15.9	15-16
Gill rakers	11	13.5+1+4	12-14+1+4	12	13.4+1+4	13-14+1+4
Standard lengths	12	—	45-56 mm	12	—	28-35 mm
Head length/S.L.	12	.324	.299-.341	12	.321	.306-.334

Table 8. Frequency distribution of photophore patterns in Stenobrachius leucopsarus

	Distribution of photophores in "VO" and "SAO" series					
	1	2	3	4	5	6
Ocean Station Papa	11(29.7%)	19(51.4%)	3(8.1%)	1(2.7%)	2(5.4%)	1(2.7%)
Off Cape Flattery	73(62%)	27(23%)	5(4.3%)	4(3.4%)	2(1.7%)	6(5.1%)

Table 9. Variation in "VO" Photophores for Stenobrachius

	Number of Photophores				
Species	3	4	5	6	$\bar{X}$
S. leucopsarus	1	35	4	0	4.1
S. nannochir	0	15	26	1	4.7

Table 10. Variation in "AOa" Photophores for Stenobrachius

Species	Number of Photophores				
	5	6	7	8	$\bar{X}$
S. leucopsarus	2	27	11	0	6.2
S. nannochir	1	15	25	1	6.6

Table 11. Variation in "AOp" Photophores for Stenobrachius

Species	Number of Photophores				
	5	6	7	8	$\bar{X}$
S. leucopsarus	0	2	28	10	7.2
S. nannochir	1	5	33	3	6.9

Table 12. Variation in "Prc" Photophores for Stenobrachius

Species	Number of Photophores				
	2	3	4	5	$\bar{X}$
S. leucopsarus	0	0	38	2	4.0
S. nannochir	1	32	9	0	3.2